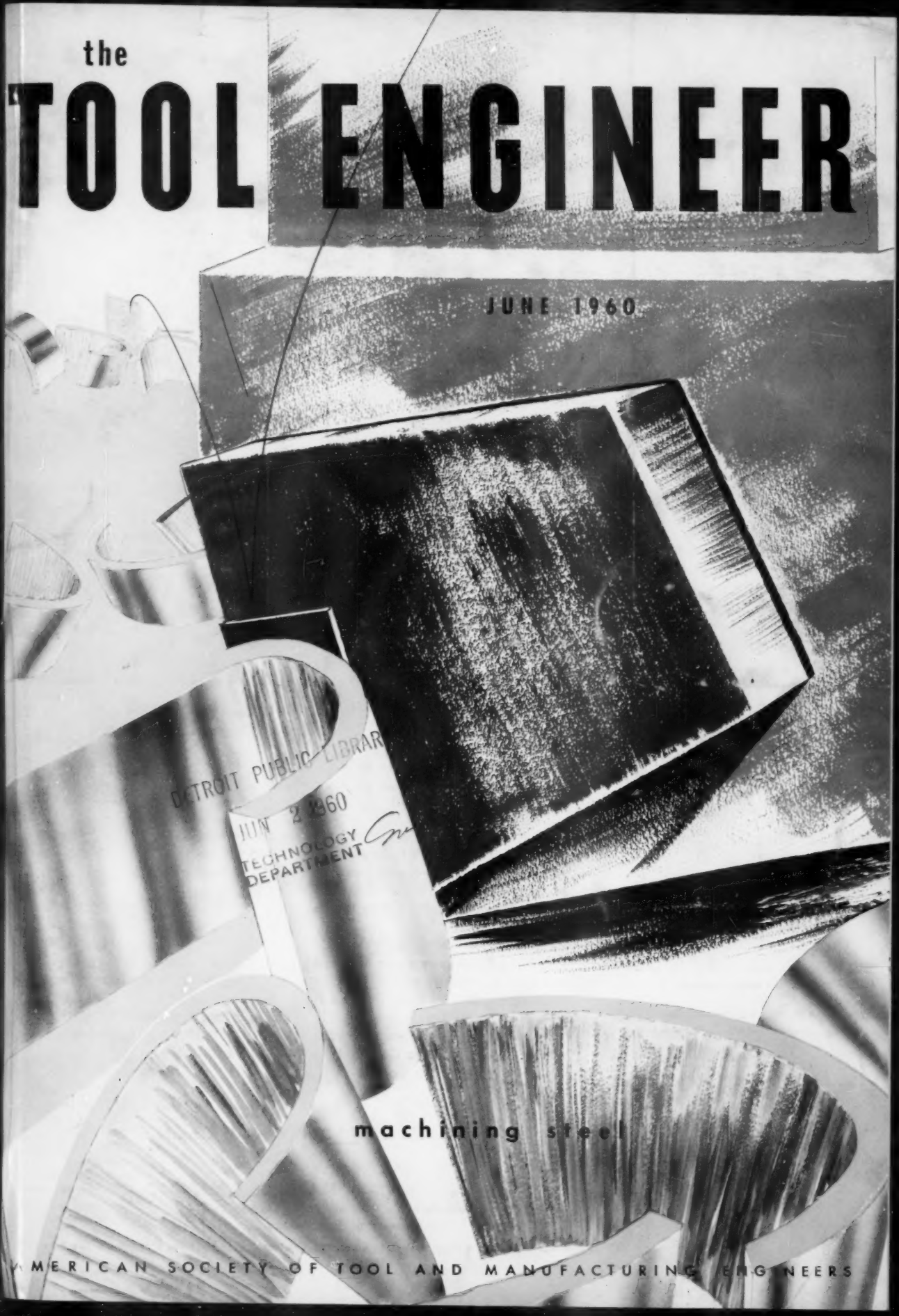
the TOOL ENGINEER

JUNE 1960



machining steel

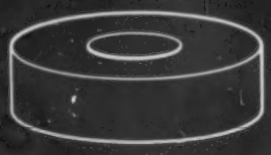
AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS

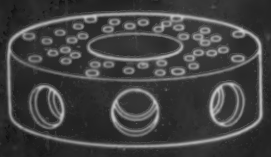
170 OPERATIONS

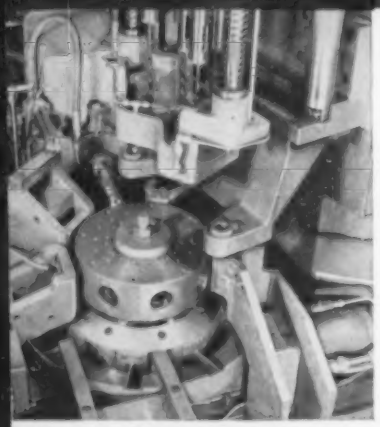
10 HOLES

starting from solid

- DRILL
- REAM
- BORE
- COUNTER-BORE
- GROOVE
- TAP

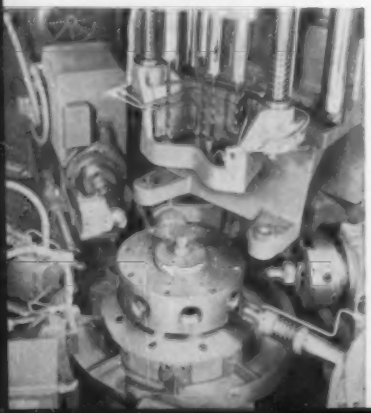






Above — Work stations on first machine (shown in large photo)

Below — Work stations on second machine



Two 6-station Model S Bore-Matics

UP PRODUCTION 519%

This cast-iron hydraulic motor body used to be produced on three different machines, with a total production time of 286 minutes per part. Now it is done on two 6-station Model S Bore-Matics in *46 minutes!*

Each machine is equipped with Heald Red Head Borizers to rotate and feed the tooling, and a rotary indexing workholding fixture. Once the part is loaded, all operations are performed in sequence in a fully automatic cycle. After operations on the first machine are completed, the work is turned over and put on the second machine where the remaining operations are finished from the opposite face.

This job demonstrates the unusual versatility of Heald Borizer units—and their ability to handle heavy stock removal while maintaining required accuracy for each of numerous sequential operations. For complete details on this particular application, send for a copy of the April 1960 issue of the "Heald Herald."

MMT-PE

It PAYS to come to Heald

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • Milwaukee • New York • Philadelphia • Syracuse

HEALD

the tool engineer

Vol. 44, No. 6
June 1960

Creative Manufacturing IS TOOL ENGINEERING

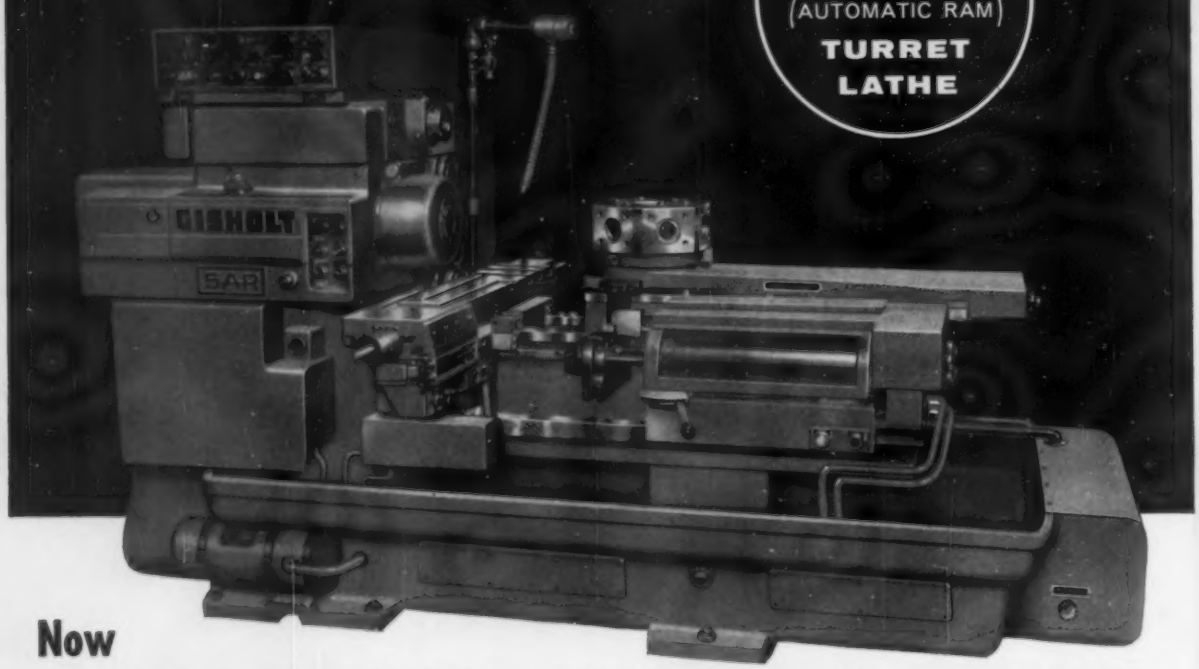
THIS MONTH'S COVER

Steel castings, such as the large power shovel ring shown being machined here, are often classed as difficult to machine. However, as explained in the article starting on page 84, use of tungsten carbide throwaway inserts and relatively high speeds gives optimum results in terms of quality and machine utilization.

THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and *Applied Science & Technology Index*. The magazine is available to libraries and other institutions in microfilm form.

ANNOUNCING

the new GISHOLT AR (AUTOMATIC RAM) TURRET LATHE



Now one machine does both bar and chucking work...automatically

Here is a ram-type turret lathe "gone automatic." It's the new Gisholt MASTERLINE AR. It handles both bar and chucking work. Changeover takes less than 1 hour. But that's not all. It combines the efficiency and consistent production of an automatic with fast setup and versatility. Yet, the new AR costs very little more than a hand-operated turret lathe!

For long runs or small lots. Whether you are now using automatics for long runs, or standard ram-type turret lathes for small lots, you'll want to evaluate this new development in automatics. You will quickly see how the new AR will cut your costs. Based on productivity, capacity, versatility, dependability, ease of operation, setup speed and original cost, you'll find it's a new best buy for your equipment dollar today!

Ask for desk-side demonstration. Your Gisholt Representative will gladly explain the cost-cutting features of the new AR and show you how it can boost profits for you. Ask for your personal, desk-side demonstration or write for literature.

Investigate Gisholt's Extended Payment and Leasing Plans

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • *Factory-Rebuilt Machines with New-Machine Guarantee*

Harry E. Conrad
Executive Secretary

Editorial Staff

John W. Greve
Editor
Theodore W. Black
Senior Associate Editor
J. Frederick Parr
Associate Editor
Robert Heslen
Associate Editor
Daniel B. Dallas
Assistant Editor
Eleanore Vinall
Assistant Editor
Particia Libel
Editorial Assistant
M. L. Stone
News Editor
Elizabeth R. Rooney
Assistant News Editor
Michael Babala
Art Editor
Henry Werner
Assistant Art Editor
Joan Crampton
Editorial Assistant

Business Staff

Michael Jackesy
Business Manager
Austin G. Cragg
Director of Sales
Peter A. Toma
Production Manager
Marjorie A. Hunt
Circulation Manager

Regional Advertising Managers

Francis Baldwin
New York
Donald N. McElwain
West Hartford
John G. Clarke
New Bedford, Mass.
George J. Zavis
Cleveland
Alan Cobleigh
Detroit
Stanley F. Girard
Chicago
Gus Krimsier
Atlanta
Robert E. Ahrensdorf
Los Angeles

Editorial & Business Offices
10700 Puritan Ave.
Detroit 38, Mich.

Regional Advertising Offices
Address and telephone numbers are listed in "Index" of Advertisers" in this issue.

Publication Office
239 E. Chicago St.
Milwaukee, Wis.

THE TOOL ENGINEER is published monthly, except semimonthly in June, in the interest of members of the American Society of Tool and Manufacturing Engineers. Second class postage paid at Milwaukee, Wisconsin. Yearly subscriptions: members, $2.00, non-members, $6.00; Canada, $6.50, and all other countries, $8.00.

Standardization and Survival

That increased production and utilization of a product result from intelligent standardization is well known and acknowledged. Resulting advantages have definitely been contributing factors in winning wars. The classic example is the Eli Whitney interchangeable musket design that impressively affected the manufacture of small arms and laid the cornerstone of our present-day production methods.

The economies of standardization can also tip the balance in favor of survival in competitive bids between manufacturers and between nations engaged in a commercial or cold war. In a desire to capitalize on these advantages, a group of manufacturers proposed a standardization program to machine tool builders at the recent meeting of NMTBA in New York City.

Their proposals envisioned a committee of nine—three each representing machine tool builders, manufacturers and the Dept. of Defense—to standardize immediately on milling, turning, drilling and grinding machines. They are well aware of the advantages accruing from uniformity that, in turn, would allow them to standardize tooling. Then jigs, fixtures, conveyors, parts handling units and chip disposal systems would be interchangeable between machines of different manufacture.

They believe the nature of these requests would not limit improvements, design developments, or restrict the creative impulses of machine tool designers. In this, they are correct. Intelligent standards free the creative mind for more important tasks. An ideal standardization program is the sum total of the best features in design that have been developed to date and that leave opportunities for further improvement whether anticipated or not.

With advantages, however, there are also hazards. Standardization programs are two-way streets. They must provide for the mutual needs of each interested group. True, a customer can demand—and get—any product that can be built for a price.

That, however, is not the ideal goal of a standardization program. Development of standards by mutual consent is worth the statesmanship necessary to achieve needed goals in a minimum time. In fact, it is safe to say that showing the way of mutual, self-interest is the quickest way to success.

John W Greve

EDITOR

Only TURBO-CUT by Threadwell has a full 3-4 thread plug chamfer!

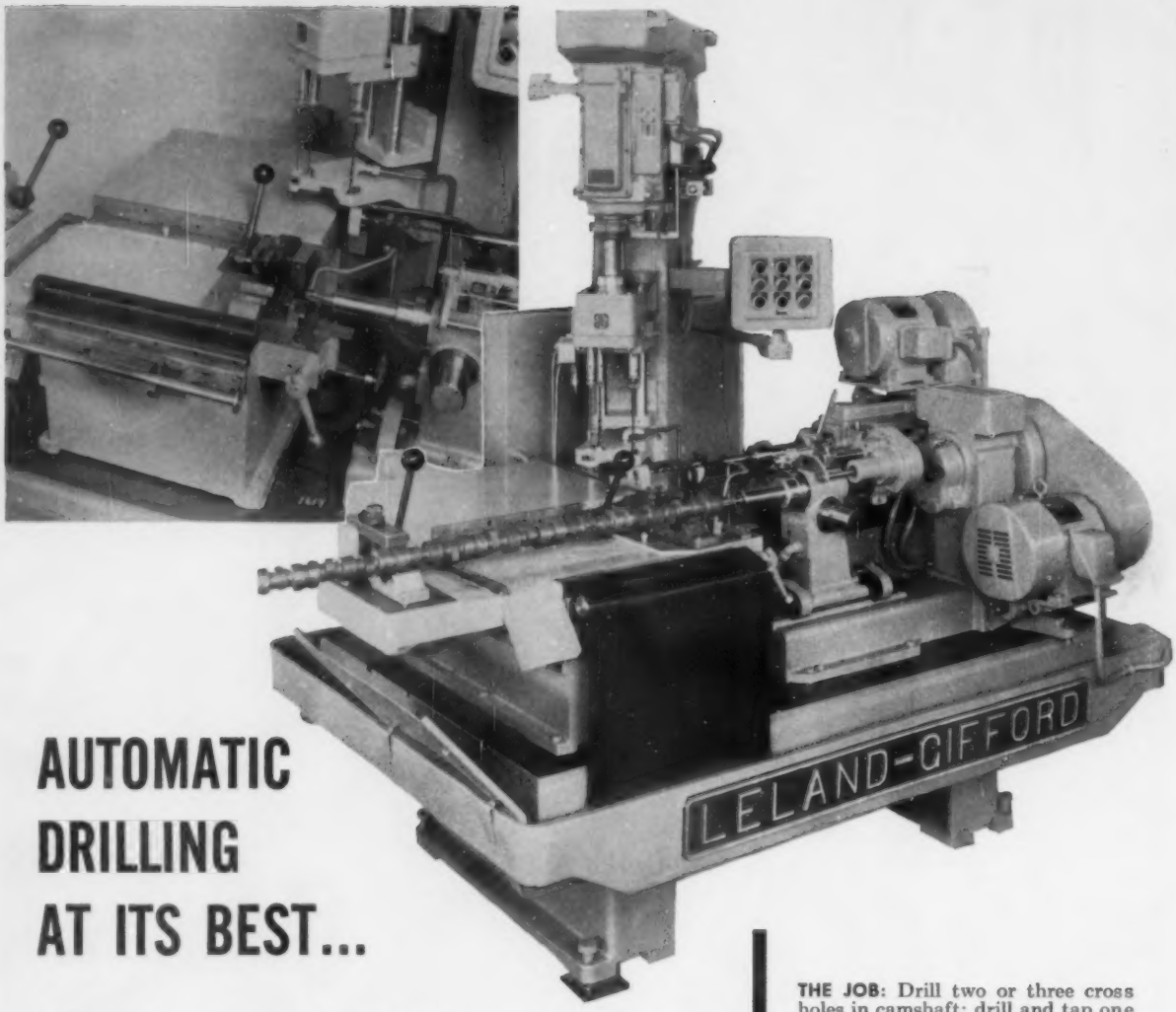
Benefit? Turbo-Cut's longer chamfer distributes the load over more teeth and breaks up chips to minimize tap breakage. Turbo-Cut's longer chamfer makes tapping easier and cleaner on through holes, does a one-pass job on blind holes. Only Threadwell makes the genuine Turbo-Cut with the longer chamfer.
Also available in bottoming chamfer.

Threadwell
MAKES THE BEST PRODUCT BETTER

INDUSTRIAL DISTRIBUTORS

THREADWELL TAP & DIE CO.
GREENFIELD, MASSACHUSETTS

Stocking Warehouses: New York — Cleveland
Detroit — Los Angeles — Greenfield, Mass.



AUTOMATIC DRILLING AT ITS BEST...

Here is automatic drilling applied to varied production that frequently includes short runs. Designed to handle fourteen different camshafts, this Leland-Gifford special drills an axial hole up to 5¾″ deep, taps the axial hole and drills two or three cross holes in each shaft. Typical production for 3/16″ axial holes up to 3½″ deep, plus cross holes and tapping, is 26 shafts per hour at 100% efficiency including handling. Change-over for different shafts is quick and easy.

Investment in this Leland-Gifford special machine quickly paid for itself.

THE JOB: Drill two or three cross holes in camshaft; drill and tap one deep oil hole in axis of shaft.

THE MACHINE: A Leland-Gifford special with two standard self-contained, step feed drilling units, one standard lead screw tapping unit, and work-handling fixture. Shafts are manually clamped and hydraulically shuttled to drilling position where all drilling units feed until interference point. Vertical unit retracts until horizontal unit completes deep hole, then finishes cross holes. Shaft shuttled to forward position for axial hole tapping.

For automatic drilling at its best, be sure to see Leland-Gifford

CALL THE OFFICE NEAR YOU

LELAND-GIFFORD SPECIAL DRILLING MACHINES

WORCESTER 1, MASSACHUSETTS
U. S. A.

Chicago 5
2515 W. Peterson Ave.

Detroit
10429 W. McNichols Rd.

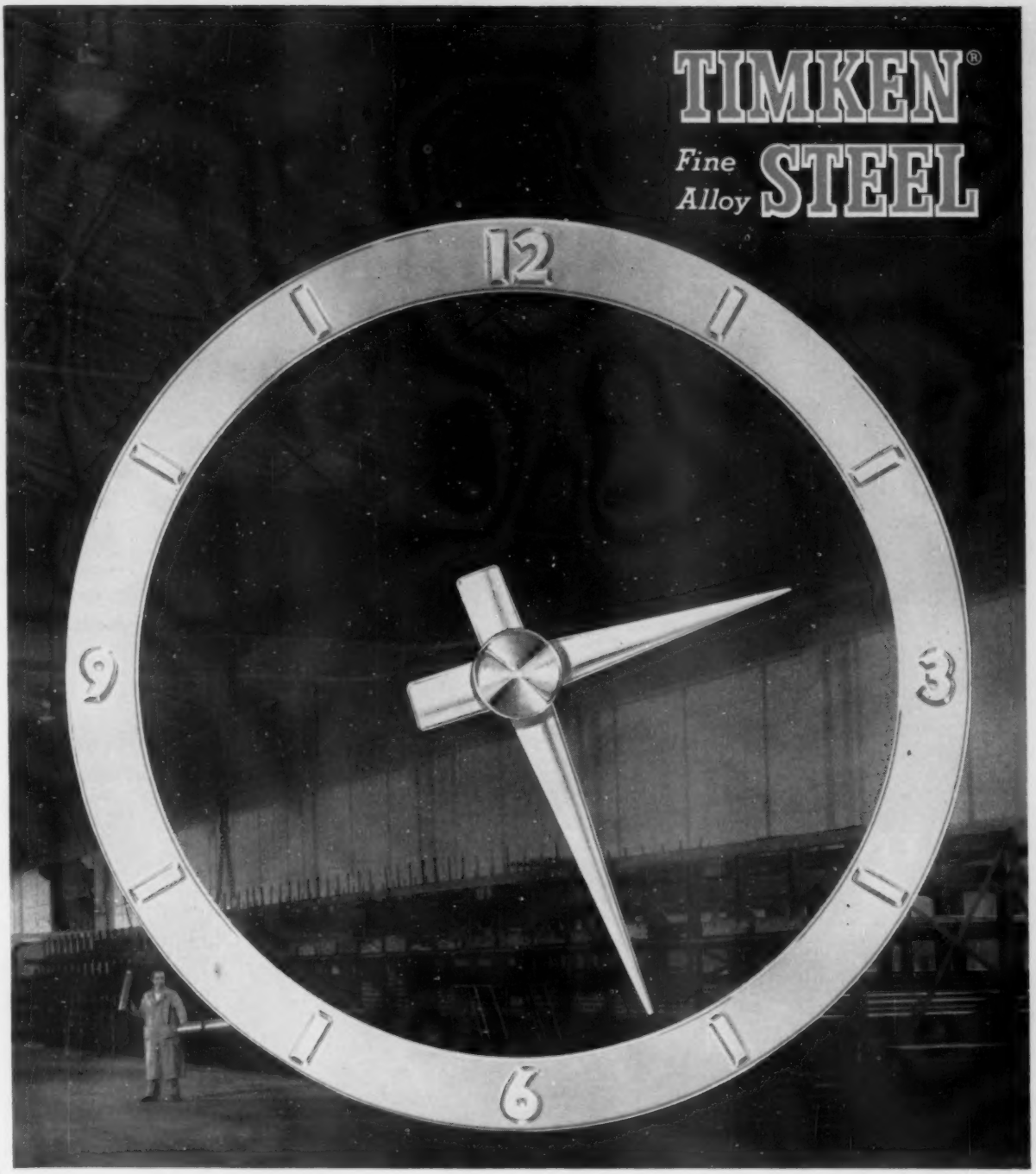
Cleveland 22
P. O. Box 853

New York Office
75 S. Orange Ave.
South Orange, N.J.

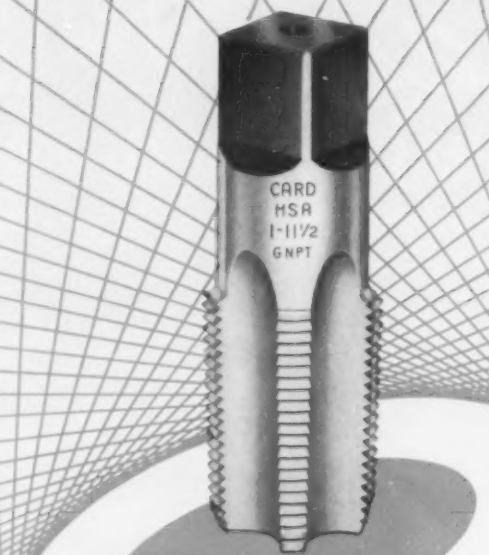
Los Angeles Office
2620 Leonis Blvd.
Vernon 58, Cal.

Indianapolis 6, P. O. Box 1051

Rochester 12, P. O. Box 24, Charlotte Station



ANY TIME is the right time to order Timken® 52100 steel tubing. We'll ship within 24 hours from our new warehouse. 101 sizes of tubing are available, ranging in size from 1″ to 10½″ O.D. with a wide selection of wall thicknesses. It's handy to use when you need less than mill quantities, too! We can also give you extra fast delivery on 51 sizes of nickel-moly tubing. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.*



CALCULATED TO CUT COSTS

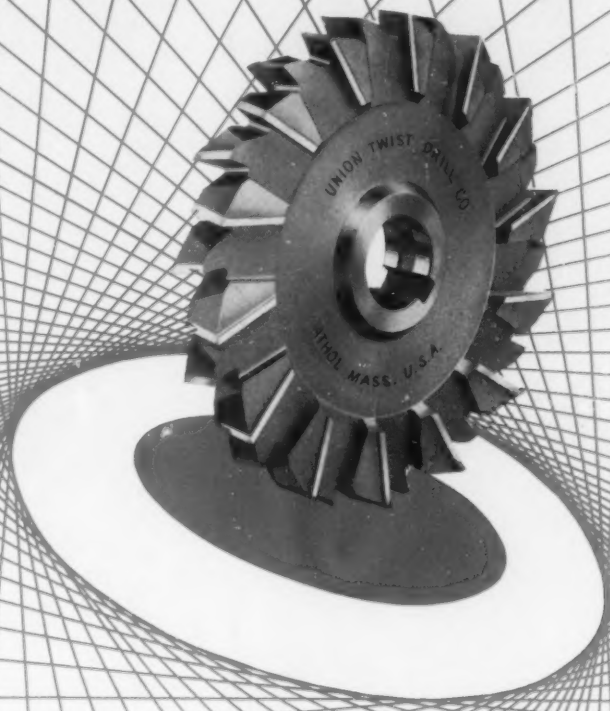
A truly geometric pattern is followed in precisely duplicating each CARD tap, according to type and size. For high volume, high quality production, specify CARD taps. Your CARD Distributor can make fast deliveries of the taps, dies, gages and screw plates you need. For helpful advice on their selection and use, call in your CARD technical man. S. W. CARD DIVISION, Mansfield, Mass.
Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth,
Los Angeles, New York and San Francisco.

CARD

DIVISION OF UNION TWIST DRILL COMPANY

Serving you through the best distributors from coast to coast

Use Reader Service Card, CIRCLE 7



GEOMETRIC PROGRESSION SYMBOLIZES PRECISE DUPLICATION

CALCULATED TO CUT COSTS

Every UNION cutting tool is duplicated with geometric precision, in each type and size. To your own plant this exact duplication of UNION inserted blade cutters brings most dependable performance, longest service life. Make sure you get these advantages. Specify UNION inserted blade cutters, drills, reamers, milling cutters, end mills, gear cutters, hobs, and carbide tools. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco.

UTD

UNION

UNION TWIST DRILL COMPANY, Athol, Massachusetts

S. W. Card Division, Mansfield, Mass. Butterfield Division, Derby Line, Vt.

Use Reader Service Card, CIRCLE 7A

***Experience**—the added alloy in **Allegheny Ludlum** tool steels*

Careful addition of sulfur to melt guarantees typical sulfide distribution, as shown in photomicrograph of longitudinal specimen of EZ MACHINING tool steel.

Sulfur addition to melt held to narrow range in Allegheny Ludlum's EZ MACHINING GRADES

Uniform, finely-distributed sulfides mean uniform machining, uniform high finish, uniform long tool life order after order

Adding sulfur, actually an impurity, to a tool steel melt to make it free-machining must be done with care and precision. That's why Allegheny Ludlum maintains an extremely close average range in adding sulfur to its EZ MACHINING grades. But mere range, however narrow, is not enough. A-L has developed special techniques in adding sulfur and nucleating agents to produce the uniform, finely-distributed sulfides that characterize good free-machining tool steels.

A-L's extra care means you can standardize your machining operations from piece to piece and order to order. This reproducibility is reflected in uniform *machining;* uniform *high finish;* uniform *long tool life.*

For example, in the production of hobs these machining properties in Allegheny Ludlum's EZ MACHINING steels minimize the costly "backing off" operation for back clearance of multiple teeth, eliminating complicated extra heat treatment. Lower residual stresses are set up, because the steel has a lower resistance to the cutting action. Naturally, hobbing is only one of the situations where these free-machining characteristics can benefit you.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier.

ALLEGHENY LUDLUM STEEL CORPORATION,
Oliver Building, Pittsburgh 22, Pa. Address Dept. TE-6

WBW 7280

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country . . Check the yellow pages

every grade of tool steel . . . every help in using it

Mr. Julian Kerlin, Field Service Engineer for Kearney-Trecker Service Division, explains the contribution of Micro-Fog Lubrication to MILWAUKEE-MATIC reliability and ease of servicing.

Norgren Micro-Fog® Lubrication gives Kearney & Trecker greater flexibility in machine design

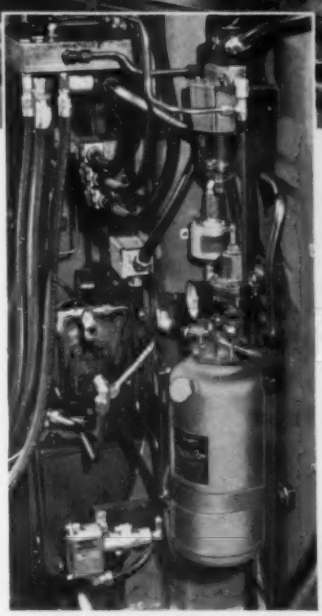
The new Kearney & Trecker tape-controlled MILWAUKEE-MATIC is an outstanding example of flexibility in modern machine design. In a single machine, the MILWAUKEE-MATIC performs all the operations of milling, drilling, reaming, tapping and boring that usually require several machines.

The Milwaukee-Matic is designed for maximum "chip time" and minimum set up and down time. This requires high reliability of operation and provision for rapid servicing.

This is why Kearney & Trecker engineers chose **Norgren** Micro-Fog for the lubrication system.

The Micro-Fog centralized air-borne lubrication system gives constant, reliable, metered lubrication at each bearing point. Alarm devices are connected to the control system of the machine to give warning of conditions affecting proper lubrication.

Micro-Fog is conducted to all bearing points through tubing, eliminating the need for cumbersome and costly return piping, oil filters, sumps and pumps. The result, as Kearney & Trecker found, is a wider latitude in machine design. With **Norgren** Micro-Fog, they were able to make maximum use of unitized construction in the MILWAUKEE-MATIC, providing for fast disassembly and component replacement.



This Norgren Micro-fog Lubro-Control Unit provides lubrication for the bearings on Kearney-Trecker's MILWAUKEE-MATIC, and for the slides, ways, gears and clutches in the head.

If you design machine tools which require measured, reliable lubrication of bearings, gears, slides, chains or ways, and want greater design flexibility, it will pay you to investigate Norgren Micro-Fog Lubrication. Write for detailed information, or call your nearby Norgren Representative listed in your telephone directory.

FOUNDED IN 1926

C.A. NORGREN CO.

3447 SOUTH ELATI STREET
ENGLEWOOD, COLORADO

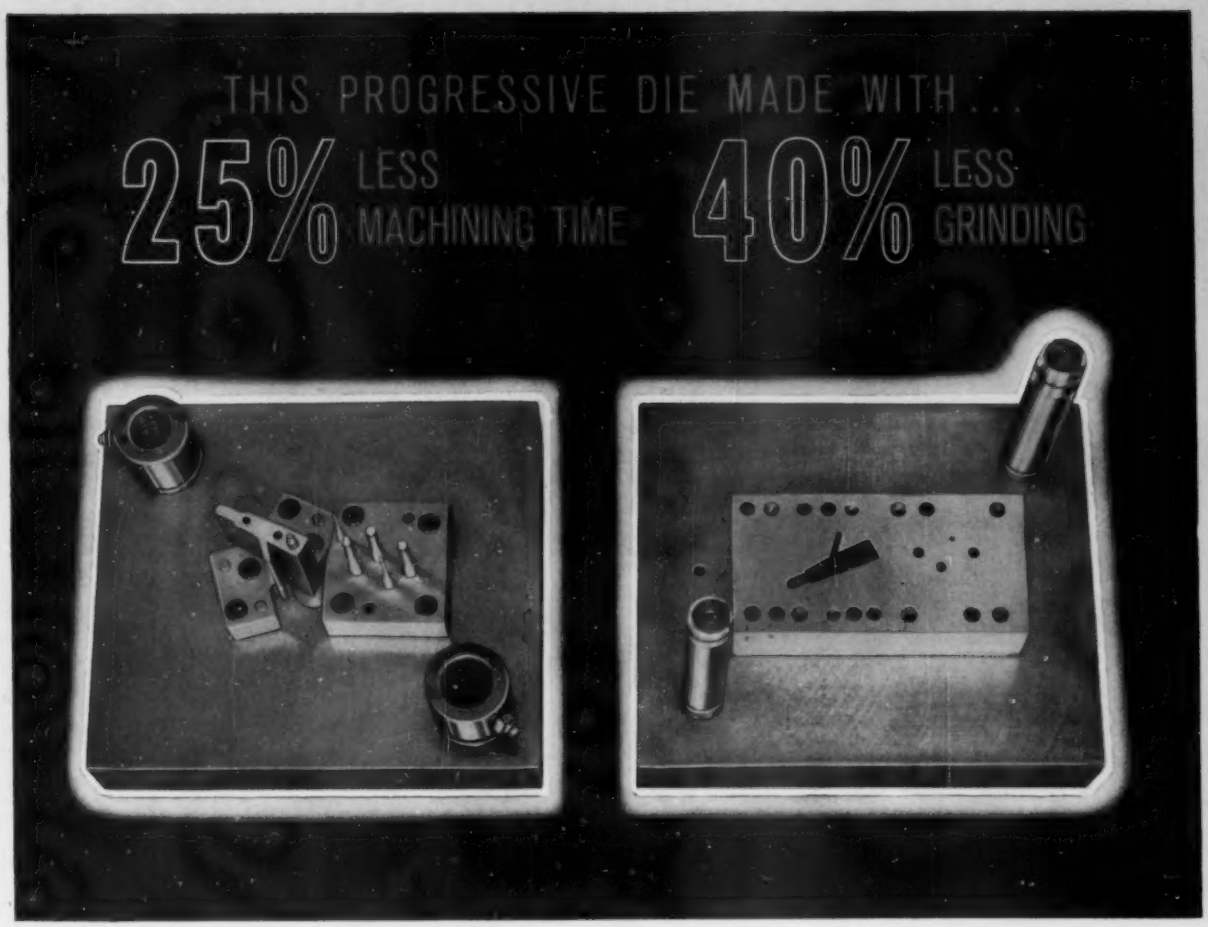
Thor

Everything you want in Torque Control···

and more!

Thor Uni-Tork screwdrivers and nut setters make torque control of threaded fasteners as simple as turning on a light. Operator judgment and guesswork is gone. Uni-Tork snaps out of engagement when desired torque is reached, snaps in again when applied to the work. Thor Uni-Tork air tools have external torque adjustments from 10 to 100 inch-pounds. Available on all Thor air screwdrivers and nut setters and on Thor electric tools. Your Thor factory representative or distributor will show you the tools that think for themselves. Thor Power Tool Company, Aurora, Illinois. Branches in all principal cities.

Thor POWER TOOLS



LO-AIR TOOL and DIE STEEL

*Low Temperature · Air Hardening**

. . . CUTS PRODUCTION COSTS

Accurate Machine and Tool Company of Roselle Park, N.J., reports savings of 40% in grinding and 25% in machining time on this progressive die—through the use of LO-AIR, the tool and die steel that is easy to machine —has least distortion in hardening.

On oil hardening tool steels, previously used for this die, .015" was allowed on sides for grinding and .005" in jig bored holes before heat treating. With LO-AIR they found it safe to allow not more than .0025" on sides and no extra in holes before hardening—making great savings possible.

For complete information, write today for Performance Report No. 20. Also, we will gladly send you a copy of our 12-page LO-AIR brochure on applications, properties and other technical data. For immediate delivery of LO-AIR, call our nearest sales office or warehouse. Complete stocks available.

**U.S. Pat. No. 2,355,224*

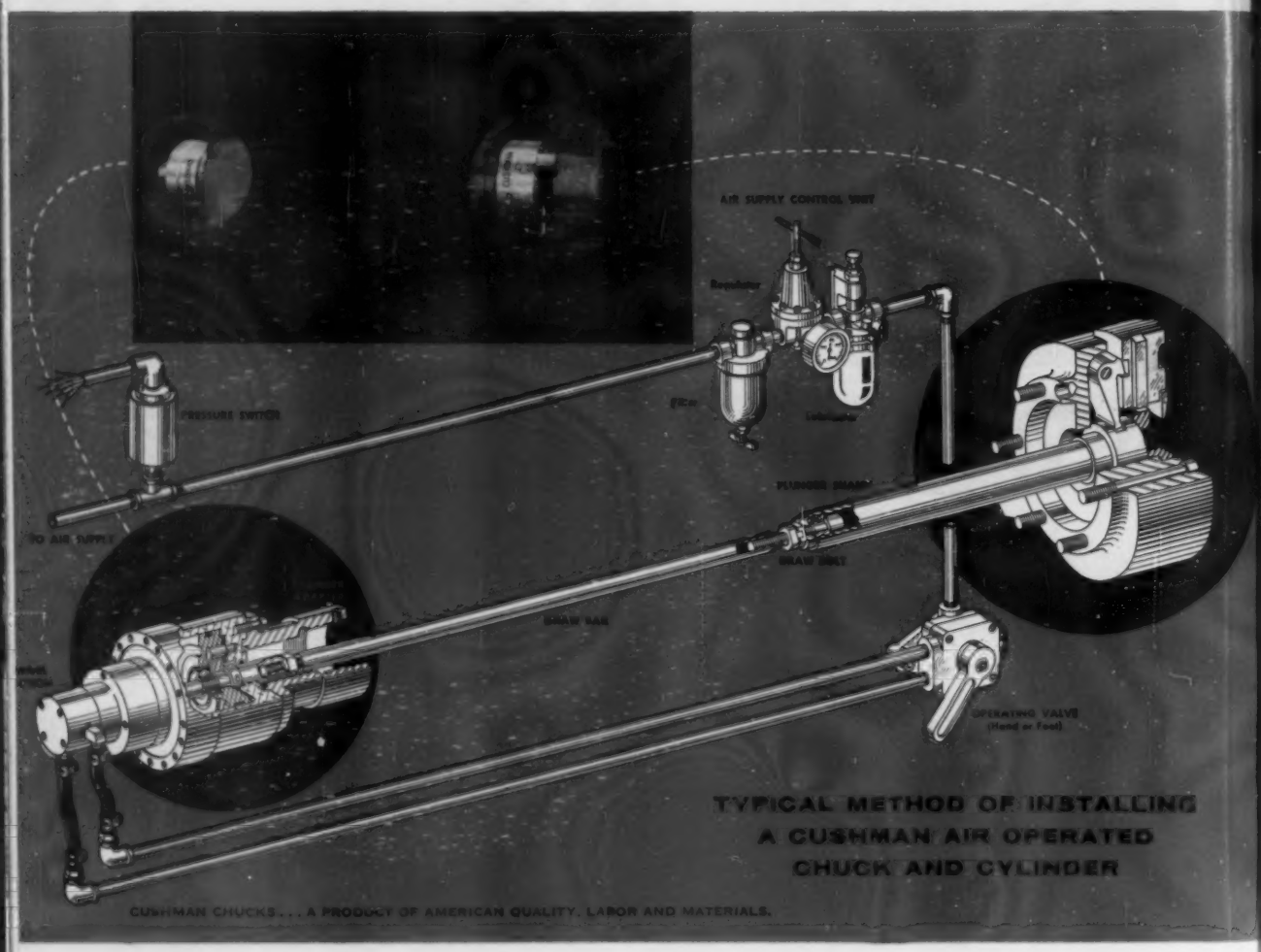
UNIVERSAL CYCLOPS
STEEL CORPORATION
EXECUTIVE OFFICES: BRIDGEVILLE, PA.

TOOL STEELS • STAINLESS STEELS • HIGH TEMPERATURE METALS

Get a production bonus with

CUSHMAN

AIR OPERATED CHUCKING EQUIPMENT



TYPICAL METHOD OF INSTALLING A CUSHMAN AIR OPERATED CHUCK AND CYLINDER

SIMPLE TO INSTALL • EASY TO OPERATE • LOW IN COSTS

Yes, Cushman Air Operated Chucking Equipment automatically provides a bonus of increased production by eliminating operator fatigue—the principle cause of rejects . . . raising production rates with better accuracy and higher efficiency . . . decreasing floor-to-floor time. Safe, positive work piece grip permits accurate control of jaw pressure for the material being machined.

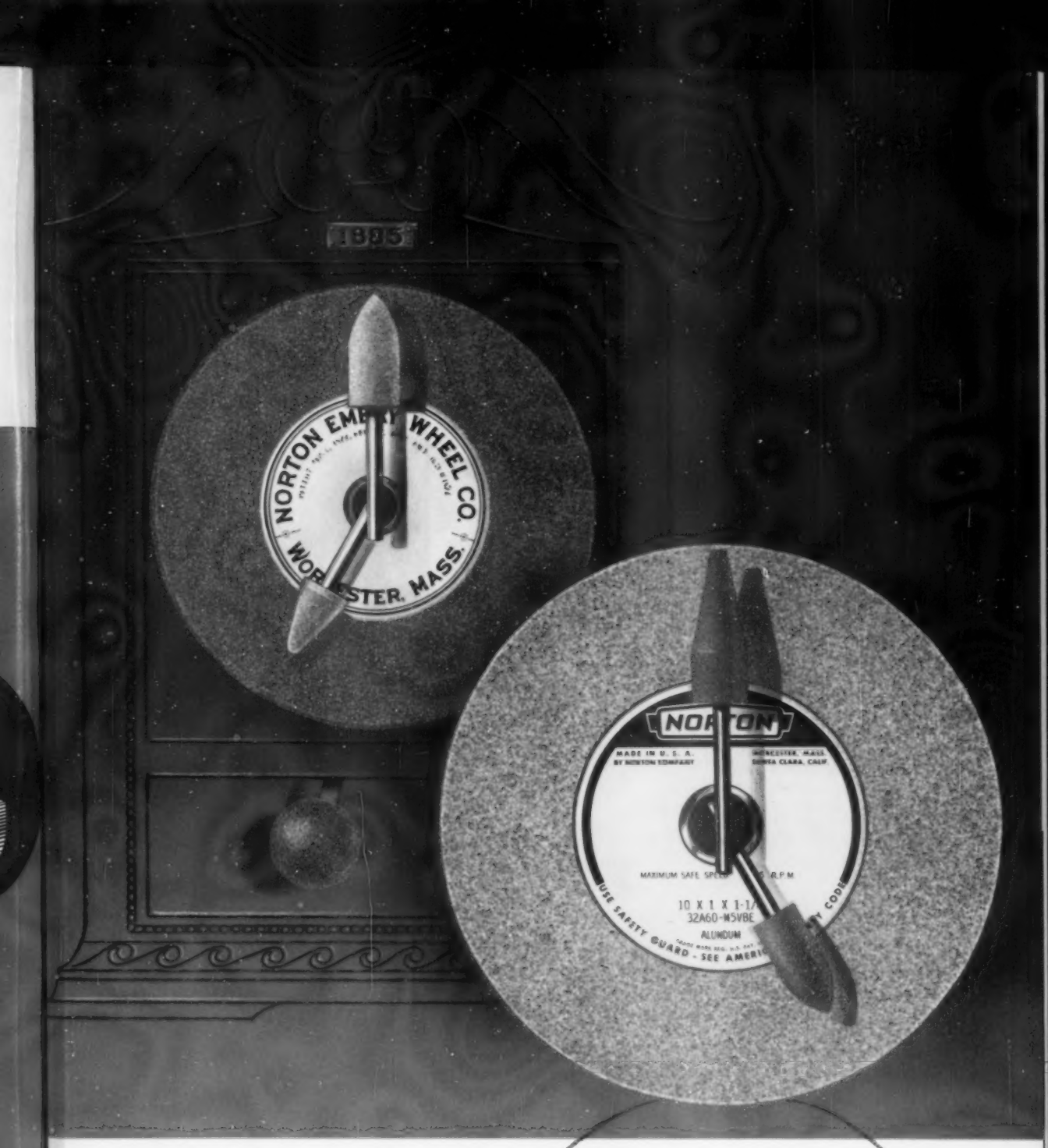
Write today for Bulletin No. PO-66D and see for yourself how you can increase production and reduce machining costs on both new and old equipment at a surprisingly low investment.

SOLD THROUGH INDUSTRIAL DISTRIBUTORS

THE CUSHMAN CHUCK COMPANY • HARTFORD 2, CONN.

MANUFACTURERS OF CUSHMAN POWER WRENCHES, MANUALLY OPERATED CHUCKS AND FACE PLATE JAWS

Use Reader Service Card, CIRCLE 12



75 years... a lifetime of progress

The Norton story begins in the dim past, farther back than 1885. But it was in that year that a group of forward looking industrialists founded the Norton Emery Wheel Company in Worcester, Massachusetts.

Today, Norton Company looks forward with equal confidence to its continued growth under sound financing, progressive management and with loyal employees. And it looks back with pride upon 75 years of steady progress in developing and applying the world's largest line of abrasives to meet the needs of industry.

It's your Norton Man's
75th ANNIVERSARY, *too*

To say that "it's your Norton Man's 75th Anniversary, too," has nothing to do with his age. But it has a good deal to do with his qualifications as your production consultant. For the experience of Norton Company — since its founding in 1885 — is, in a very real sense, his own personal background.

For example, your Norton Man's thorough training at the Worcester Plant is based on the Company's 75 years of developing the world's largest line of abrasive products — including the widest range of grinding wheels, from mammoth pulpstones to miniature mounted wheels; discs and segments; abrasives for polishing, lapping, tumbling and pressure blasting.

Typical Norton Advancements

Norton was first to introduce all three bond types of diamond wheels, and now uses man-made as well as mined diamonds to meet today's broader needs . . . introduced NORBIDE® boron carbide, next to diamonds the hardest material ever made by man for commercial use . . . and the latest Norton advancement is the opening of another new five-acre plant, built for the sole purpose of using new, modern methods to manufacture resinoid bonded wheels, favorites among foundries and other users. Besides developing these and many other types of abrasive products, Norton has constantly improved grinding techniques throughout industry.

Your Norton Man's Heritage is this wealth of technical know-how gained by Norton in 75 years, backed by his own practical training and field experience. As your Abrasive Engineer, this combined background qualifies him to give you expert advice on the selection and use of grinding wheels. He'll supervise test runs of wheels in your plant and will give you every aid in bringing the lowest cost-per-piece to your production economy.

Nation-Wide Deliveries and Service

In the United States, Norton manufactures in Worcester, Mass., and Santa Clara, Cal. and maintains immense factory stocks plus warehouse stocks in five conveniently located cities. Norton distributors in 283 cities keep their stocks fully adequate to the needs of their areas. For prompt deliveries, helpful service, and contact with your Norton Man, call your Norton distributor.

NORTON
ABRASIVES

NORTON COMPANY • WORCESTER, MASS.

District Offices: Atlanta • Chicago* • Cleveland* • Detroit* • Hartford • Los Angeles Area (Huntington Park) Indianapolis • New York Area (Teterboro, N.J.) • Philadelphia* • Pittsburgh* • St. Louis

*Warehouse Facilities and Stocks at this location

BEHR-MANNING CO., Troy, N.Y. is a Division of Norton Company

75 years of . . . Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

4-60

A COMPLETE GEAR PROGRAM

TO ASSURE YOUR PRODUCT'S EFFICIENCY

MMT-PE — Modern Machine Tools — Production Efficiency

Visit us at the Machine Tool Exposition, Booth No. 242

Whenever you have a gear problem—any gear problem—consult Illinois Tool Works for the right answer!

From transmissions to turbines—from radar antennas to atomic reactors—if your product requires gears or gear trains, Illinois Tool Works has the experience, skill and facilities to solve your gearing problems.

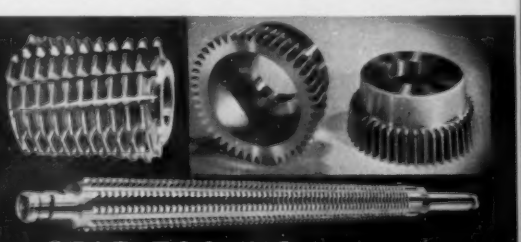
Gear users and gear producers are now offered valuable assistance in gear analysis, gear design, prototype and model manufacture, gear tooling and quality control. This complete program is available to help you improve product efficiency and economy to strengthen your competitive edge.

As a proven advisor to the Army, Navy and scores of power-product manufacturers, Illinois Tool has gained the background and engineering know-how to accurately analyze your gearing problem and to recommend the most satisfactory solution for your specific requirements. This service even includes training your personnel.

Write Today for your "Gear Technical File"

GEAR QUALITY CONTROL

Gear specialists at Illinois Tool have developed gear-measuring instruments, ranging from simple hand rolling fixtures to fully automated final gear inspection machines. Among these are units capable of mechanically inspecting hundreds of gears per hour for all known elements and sorting them categorically. Whatever your quality control requirements let Illinois Tool recommend the system best suited to your needs.

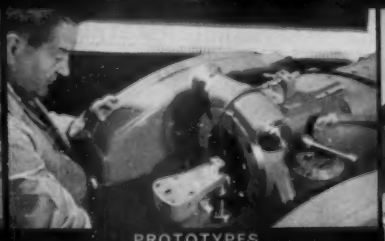


GEAR TOOLING

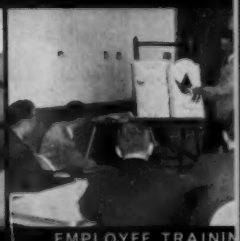
Illinois Tool Works hobs, shaper cutters, broaches and gear cutters are used to produce thousands of gears daily. They are specified by nearly every major gear producer in the country—proof of their quality, efficiency and economy.

INSPECTION

ANALYSIS AND DESIGN



PROTOTYPES



EMPLOYEE TRAINI

GEAR SERVICES

Illinois Tool Works maintains (a) a complete atmosphere-controlled laboratory fully equipped for analyzing and inspecting gears, gear trains or gear-like parts; (b) an engineering staff to design and/or recommend gear drives; (c) development facilities to produce models and prototypes; (d) a process group to detail production and quality control procedures; (e) employee training for your personnel which includes a highly concentrated classroom-and-shop course in gear engineering, production and quality control.

ILLINOIS TOOL WORKS

TOOL & INSTRUMENT DIVISION

2501 North Keeler Avenue • Chicago 39, Illinois

In Canada: CITCO DIVISION, CANADA ILLINOIS TOOLS, Ltd., Don Mills, Ontario

ANOTHER "BUILDING BLOCK" BY HARTFORD Special

AIR HYDRAULIC DRILL UNIT

- 4" STROKE • UNITIZED
- SMALL SIZE • INTEGRAL AIR VALVE
- FIELD TESTED

COMPLETE INFORMATION . . . on the new Model 17-400 Drill Unit, including dimensions, specifications and other engineering data, is covered in Circular No. GC-400. Write now for your free copy.
The Hartford Special Machinery Co.,
3800 Homestead Ave., Hartford 12, Conn.

HARTFORD Special

THE HARTFORD SPECIAL MACHINERY COMPANY
HARTFORD 12, CONNECTICUT

JOB: Drilling manifold stud holes in compressor cylinders. Formerly, with universal electric drill, it took 10 minutes per hole (and a lot of muscle).

RESULTS: Changeover to a Rotor E-01P Air Drill at 950 r.p.m. cut time to 4 minutes . . . netted a saving of 60%. Reduced operator fatigue and improved quality. The Rotor Air Drill has been in service a year without a cent for maintenance.

Find out how Rotor portable tools can improve *your* production. A demonstration in your shop will be made at your convenience. Write for free copy of Bulletin 53-B.

10-minute job now takes 4 minutes with

Courtesy Davey Compressor Company, Kent, Ohio

Here's the RIGHT TOOL for YOUR job!

ROTOR TOOLS

The Rotor Tool Company · Cleveland, Ohio

ROTOR AIR TOOLS: Assembly Tools • Drills • Small Wheel Grinders Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers Special Tools • Air Motors

ROTOR HIGH-CYCLE ELECTRIC TOOLS: Grinders • Polishers • Sanders

RIVETT... *is the one source for the correct valve, to control all or part of any hydraulic circuit!*

Whatever your requirements, you can find the right valve at Rivett. Save time, money, inventory and maintenance with these most advanced designs. Greater flow capacity; minimum pressure drop; positive damping and operating stability. From single basic assembly of functional valve any one of six functions may be obtained. Over 400 standard models—sub-plate and pipe mounted; direct control and functional. Pressures 1500 and 3000 P.S.I. All actions, all piston designs, all operations. Sizes ¼" to 2". J.I.C. standards.

RIVETT, INC.
Dept. TE-6 Brighton 35, Boston, Mass.

The Better You Know Hydraulics—
The Better You Like

Cat.'s 204, 210, 230 and 261 contain 68 pages describing all valve models, sizes and types with complete working drawings, specifications, performance, ratings, cut-away views. Get free copies today.

RIVETT
HYDRAULIC VALVES

Want low-cost parts finishing?

NOW—CHOOSE FROM

7 NEW ALMCO VIBRASHEEN MACHINES

TO DO YOUR

- **DEBURRING**
- **DESCALING**
- **BURNISHING**
- **SURFACE REFINEMENT**
- **CLEANING**

10 to 100 Times FASTER!

7 SIZES FOR EVERY JOB REQUIREMENT

Model	Tub Capacity	Tub Size, Inside		
		Length	Width	Height
VT-70	¾ gallon	7″	4¾″	6″
VT-71	1 cu. ft.	12″	12″	12″
VT-72	2½ cu. ft.	15″	16″	18½″
VT-75	5 cu. ft.	31″	17″	19½″
VT-77	7 cu. ft.	31″	17″	22½″
VT-712	12 cu. ft.	35″	25″	30⅜″
VT-717	17 cu. ft.	47″	25″	30⅜″

New VT-72 Vibrasheen being unloaded into optional hoist-pan. Note convenient height of controls.

ANOTHER REPORT FROM THE ALMCO ALBUM OF NEW PRODUCTS

IT'S A FACT! With the seven (7) new ALMCO Vibratory Machines, you can expect finishing time cycles 10 to 100 times faster than with standard horizontal barrel finishing equipment. It's a significant production break-through, made possible by creating constant vibratory motion to activate the entire mass of media and parts in the finishing container, as compared to only 20% activation with conventional barrel finishing methods.

The uniform vibratory motion of the media in recessed areas, blind holes and small I.D. dimensions make it possible to obtain optimum results on a multitude of applicable parts with intricate configurations that can not be completely processed in standard horizontal barrel machines.

What's more, this amazing metal finishing machine only requires 50% of the floor space that is taken up by any other machine of this type with a similar capacity. Time and motion is at the absolute minimum with all convenient operating conditions.

Tub features. Holds a 2½ cu. ft. load of parts and media. Equipped with vibrating mechanism adjustable for impact range of from 600 to 2550 lbs.; has a vibration frequency of 3380 rpm with variable drive optional. Pivots through 180° arc. Lined with tough ⅜″ plastisol. Quick-acting cam-lock drain door facilitates flushing of tub.

Investigate today, the ALMCO *Vibra-Sheen way!*

FREE

NEWS ABOUT ALMCO'S NEW PRODUCTS

New Almco Album describes the latest in metal finishing machines, methods and media. Write today for free copy!

ALMCO

Queen Products Division • King-Seeley Corporation

186 E. Main St. • Albert Lea, Minnesota

SALES AND ENGINEERING OFFICES: Chicago, Detroit, Los Angeles, Newark, New Haven, and Philadelphia

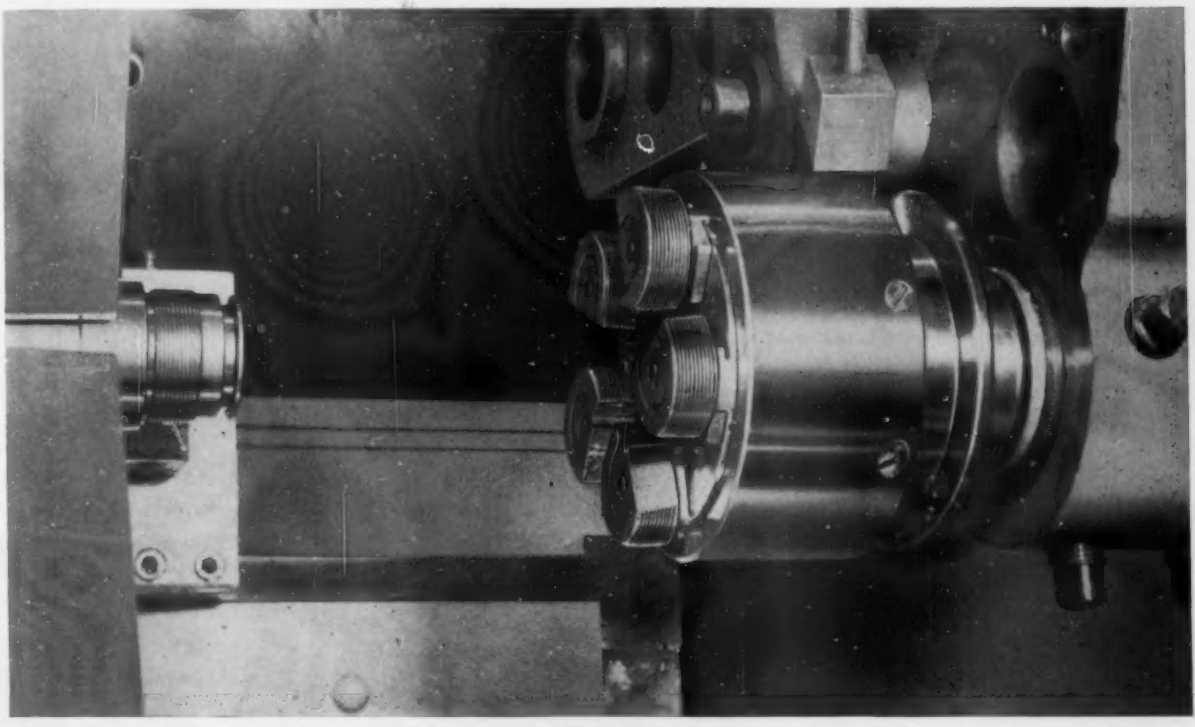
IN ENGLAND: Almco Division of Great Britain, Ltd., Bury Mead Works, Hitchins, Herts, England

Screw machine job shop standardizing on 5-Chaser Vers-O-Tools . . .

Two precision parts for hydraulic devices threaded with 5-Chaser Vers-O-Tool. Both have pitch diameter tolerances of .0045" (class 3 threads).

"The only economical way to meet tough threading specs"

"Extremely high threading tolerances have become the rule rather than the exception on most of our jobs," states Henry Libicki, Chief Engineer, U. S. Automatic Corp., Amherst, Ohio. "We're convinced the only economical way to meet these increasingly tough specifications is with National Acme 5-Chaser Vers-O-Tools. In every instance, they give us far more accurate threads than 4-chaser tools . . . have helped us keep pace with our customers' requirements and attracted more profitable business. We've started a change-over program to 5-Chaser Vers-O-Tools. It's a vital step in the constant improvement of our operation." Enthusiastic comments like these sum up the feelings of hundreds of users of NAMCO 5-Chaser Vers-O-Tools. In your plant they'll give more pieces per grind, highest threading accuracy, and the economies of greatly reduced set-up time. NAMCO 5-Chaser Vers-O-Tools are available *from stock* in a *complete* range of sizes. Get all the details. Contact your local National Acme Sales Engineer, or write for Bulletin DV-1.

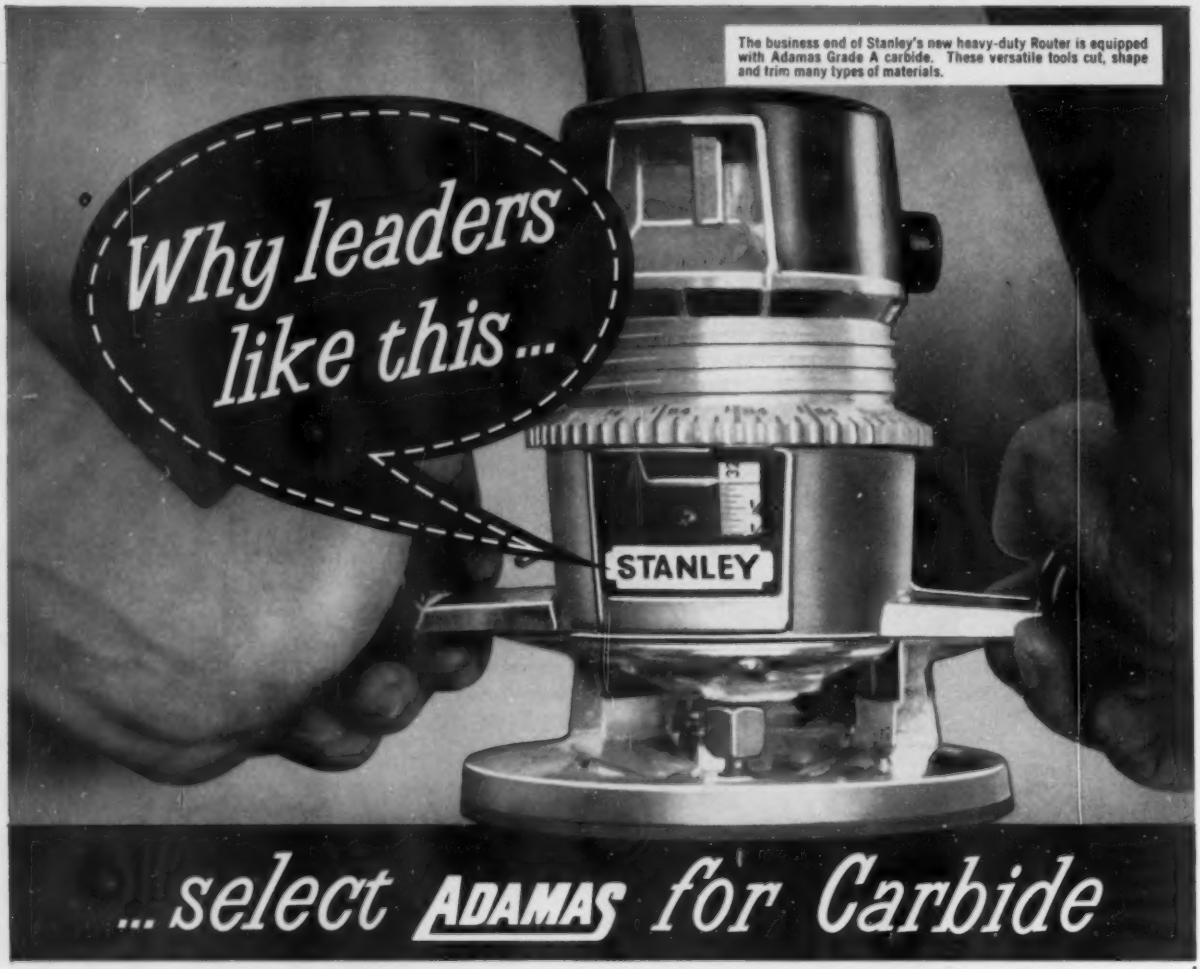


5-Chaser Vers-O-Tool was easily installed on existing single-spindle machine. A tripping mechanism using a solenoid and a micro switch attached to the Vers-O-Tool provides automatic control of die-head trip-off to within .002" to .003" at shoulder. (*Developed at U.S. Automatic Corporation.*)

National Acme

The National Acme Company
193 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.



The business end of Stanley's new heavy-duty Router is equipped with Adamas Grade A carbide. These versatile tools cut, shape and trim many types of materials.

...select ADAMAS for Carbide

■ There are always universally recognized leaders in every field . . . in electric tools—one of these is Stanley. Ever watchful of this unquestioned leadership, Stanley selects only component materials that meet its own exacting standards of quality. Every piece of original equipment must pass rigid specifications.

If you need a specific grade of carbide to use in your plant, or to build into your product, Adamas can offer helpful recommendations for your individual requirements. Experienced Adamas engineers are available for consultation without obligation.

An inquiry will bring a prompt response.

Producers of
Tungsten Carbide Tools,
Tool Tips,
Dies, Wear Parts,
Dex-A-Tool

ADAMAS CARBIDE CORPORATION
KENILWORTH, NEW JERSEY

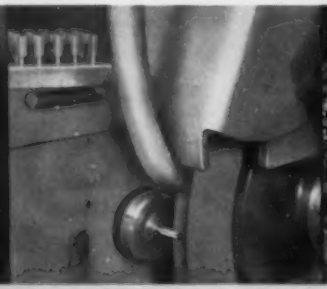
PROGRESSIVE CARBIDE USERS SELECT BY Performance ...NOT HABIT!

HERE'S HOW ADAMAS CARBIDE HELPS STANLEY MAINTAIN ITS SUPERIOR POSITION . . .

STANLEY

This famous trademark distinguishes over 20,000 quality products of The Stanley Works, New Britain, Conn. —made in 24 plants in the United States, Canada, England and Germany.

Shown discussing the quality requirements for a new Stanley product, are (l. to r.) James Scalise, General Foreman; Raymond Nagy, Adamas Representative; Milford Borrows, Research Manager.



Precision OD grinding at Stanley Electric Tools . . . The finishing operation—back-off or relieving flutes—is on Adamas Carbide tipped tools.

Stanley inspector, Angeline Jurewicz, at one of the many quality control stations, checks the finished carbide parts prior to assembly into Stanley products.

Above: "Bridgeports" in the Mathewson Tool Co's. Shop, Orange, Conn.

Above: "M14 Springfield Rifle" (Official gun for "Nato.")

"The Most for the Least"

Regardless of the size of your shop, be it large or small. Why not get all the facts concerning the "Bridgeport" and the many reasons why it is such a popular and profitable tool in the metal working market. Contact your nearest dealer or us direct for details.

The modern, highly efficient plant of the Mathewson Tool Company, Orange, Connecticut, is literally built around Bridgeport Millers.

The very first "M14 Springfield Rifle" (official gun for "Nato") was prototyped on Bridgeport Machines and according to Mr. Mathewson, President, "Our present 16 Bridgeports, with their precision, versatility and reasonable price helped us tremendously to build a modern and profitable business."

The experience at Mathewson Tool Company while most interesting, is by no means exclusive with this shop. It is, however, an outstanding example of what is being accomplished in metal working by Bridgeports and again points the way to lower costs and better profits through modernizing the "Bridgeport Way."

Bridgeport MACHINES, INC.

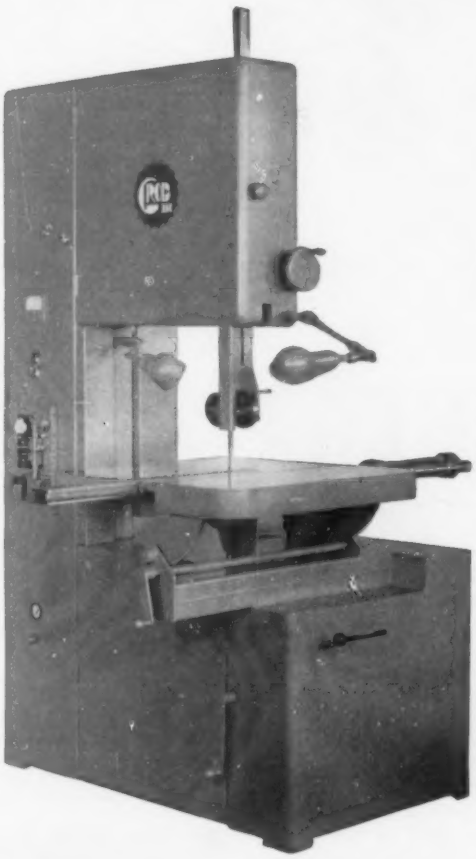
Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

GROB SPELLS THE DIFFERENCE IN BAND SAW MACHINES

The new GROB 24" universal band saw has all the famous GROB features:

Quality • Efficiency • Durability • Strength
Utility • Low Maintenance • Reasonable Cost



- Speeds infinite from 35-12000 FPM covers both cold and hot sawing
- Variable drive 3-speed transmission with precision rolled gears and splines transmits 15 HP
- Hydraulic table feed

See the difference demonstrated in our dealers' showrooms

or

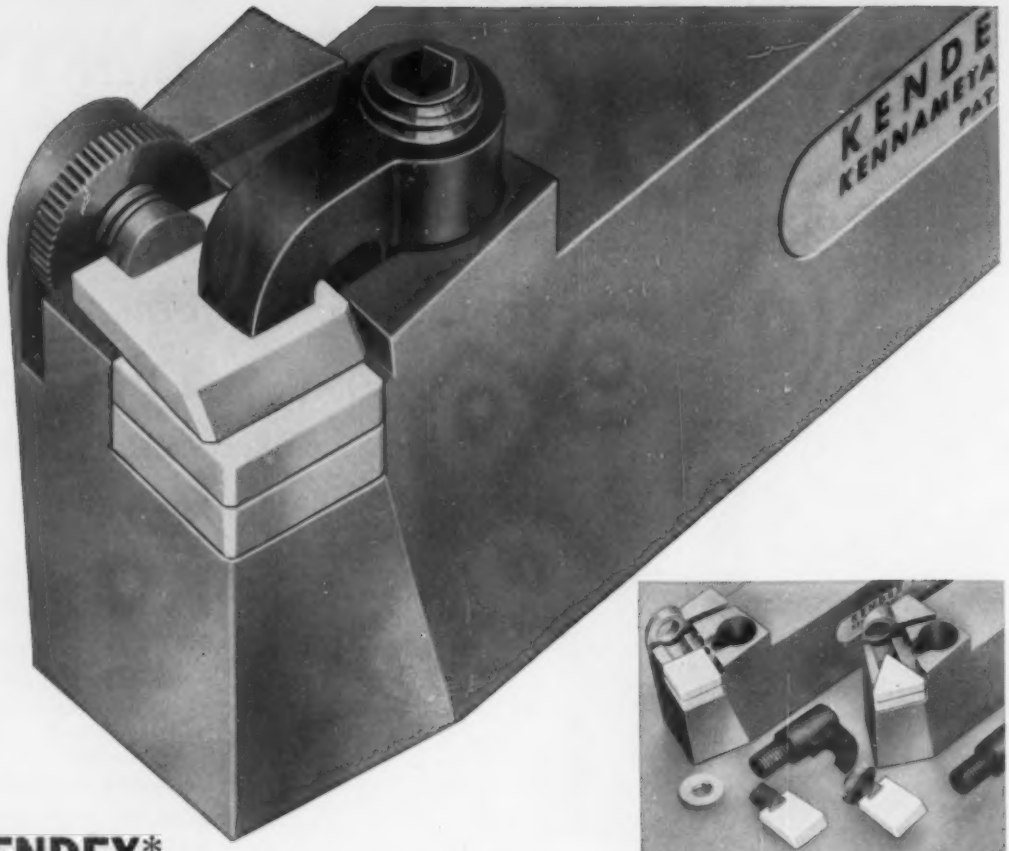
Write GROB INC. for complete specifications

GROB also manufactures a complete line of:

BUTT WELDERS
FILING MACHINES
GEAR ROLLING MACHINES

GROB INC

GRAFTON, WISCONSIN



NEW KENDEX*

DIAL-A-BREAKER

Easily adjustable . . . attached chipbreaker

Quickly, easily . . . set the chipbreaker where you want it, regardless of holder position. The new Kendex Dial-A-Breaker eliminates fumbling and fussing while changing and adjusting chipbreakers and inserts. Chipbreaker is brazed to its adjustment screw. *It can't fall out, and the breaker setting may be retained while indexing or changing inserts.*

You no longer need a different breaker for every cutting job. Now you just turn the dial and position one chipbreaker for *several* jobs. Minimum of parts to stock . . . only two chipbreakers required for 70 styles and sizes of holders.

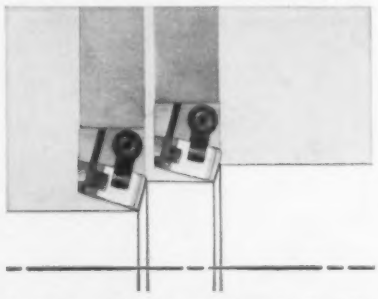
Close ganging of tools presents no adjustment problems with the Kendex Dial-A-Breaker. *All* changes and adjustments . . . chipbreaker and insert . . . can be made from the top of the holder. (The clamp screw is also accessible from the bottom of the tool when mounted in an inverted position on the rear carriage.)

Kendex Dial-A-Breaker Tool Holders have the same basic design and accommodate the same solid Kennametal shims and "throw-away" inserts as used in standard Kendex holders. They are available in positive or negative rake, and with square or triangular inserts.

Get more information. Ask your Kennametal Representative for a demonstration . . . or write KENNAMETAL INC., Latrobe, Pa. 23501

*Trademark

Holders illustrated with clamps and chipbreakers removed show positive seating of both triangular and square inserts. When not required, tool may be used without chipbreaker, with clamp set directly on the insert.

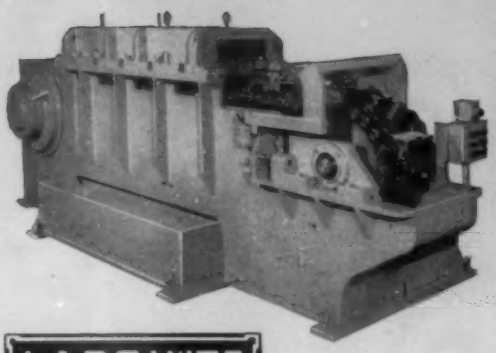


Easily accessible for adjustments. Permits close ganging of tools.

Easy adjustment, regardless of tool position. Just release the clamp and "dial" the breaker to any position desired.

INDUSTRY AND
KENNAMETAL
...Partners in Progress

The European builder of a famous sports car is producing 1400 completely-broached rocker arms per hour on this horizontal LAPOINTE CONTINUOUS **BROACHING MACHINE**



Broaching is done after the bronze bushing has been pressed into place, locating from the shaft hole and adjacent face.

Look at all the broached surfaces on the rocker arm forging . . . and then think of getting 700 right-hand and 700 left-hand pieces per hour off this machine! It's not surprising that the Lapointe *Continuous-Broaching* Machine is as popular in that automotive manufacturer's plant, as it is in this country!

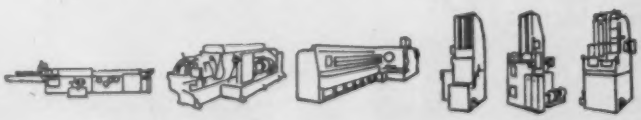
In your plant, are you milling where you might be using Lapointe-Broaching to better advantage? Are you boring, turning, shaping . . . when Lapointe-Broaching could step up your production rate, reduce your costs, *improve your quality?*

If you aren't absolutely sure that your present machining methods are the most practical and economical methods to use, why not invite a qualified Lapointe Field Engineer to consult with you? You may be surprised at the help he can give you, right out of his own experience!

THE LAPOINTE MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES



LAPOINTE

known to be the best in

BROACHING

One of a series

Higher Education for Computers

"Let's put the computer in at the start of a problem, rather than just having it buzz through the computations."

This is the approach being taken by computer specialists at the General Motors Research Laboratories as they explore ways of giving large-scale digital computers a greater role in the solution of problems. The object is to "teach" computers to apply the same rules men use in formulating, analyzing, and solving questions of modern science and engineering.

A recent outgrowth of this work is DYANA, GM Research's new automatic analysis and programming system. DYANA is one of the first computer systems to "understand" declarative statements. For a large class of dynamic problems, the engineer can simply describe his physical system to the computer. The computer figures out how to handle it.

For the solution, DYANA automatically directs the computer to prepare a mathematical model of the system, to write its own program for solving the model, then to execute the program and compute the desired answers.

The higher education of computers currently involves studies in symbol manipulation, problem-oriented languages, character and pattern recognition, and engineering simulation.

Such advanced computer concepts are giving General Motors professional people more time for creative engineering and research—time to explore ideas and to develop "more and better things for more people."

General Motors Research Laboratories

Warren, Michigan

Comparison of program tapes for a vibrational problem expressed in DYANA language, in algebraic-oriented language, and in the basic machine language.

Use Reader Service Card, CIRCLE 27

The American Brass Company
Waterbury 20, Conn.

Please send me a copy of your 8-page booklet which details properties of your four free-cutting, high-conductivity coppers, and suggested machining practices.

Name.....

Company.....

Street.....

City.....Zone.....State.....

4 ways to cut the cost of high-conductivity parts

There are now four free-cutting, high-conductivity Anaconda coppers that broaden the combinations of mechanical, physical, and fabricating properties available for boosting production and cutting costs of high-conductivity parts. They are furnished chiefly in rod and bar, but are available also as extruded shapes and, except for the leaded coppers, die-pressed forgings of simple design. All have good cold-working properties.

Leaded Copper-126 and Deoxidized Leaded Copper-129 have slightly higher electrical conductivity—98% IACS annealed, 95% IACS, minimum. The difference between them is that Alloy 129, being deoxidized, is not subject to hydrogen embrittlement when annealed or furnace-brazed in reducing atmospheres. Neither leaded alloy is recommended for hot working.

Tellurium Copper-127 and OFHC Sulfur Copper have an electrical conductivity rating of 95% IACS annealed, 90% minimum. Both may be extensively hot worked and neither is subject to hydrogen embrittlement. Tellurium Copper-127 has the advantage of retaining its mechanical properties at temperatures higher than those tolerated by the other free-cutting coppers—and hence is widely used in the welding and cutting-tip field.

The free-cutting coppers may be machined at cutting speeds approaching those used for machining Free-Cutting Brass. For Tellurium Copper-127, however, carbide-tipped tools are recommended as the inherent copper telluride particles cause somewhat greater tool wear.

6047

ANACONDA®

FREE-CUTTING HIGH-CONDUCTIVITY COPPER PRODUCTS

Made by The American Brass Company

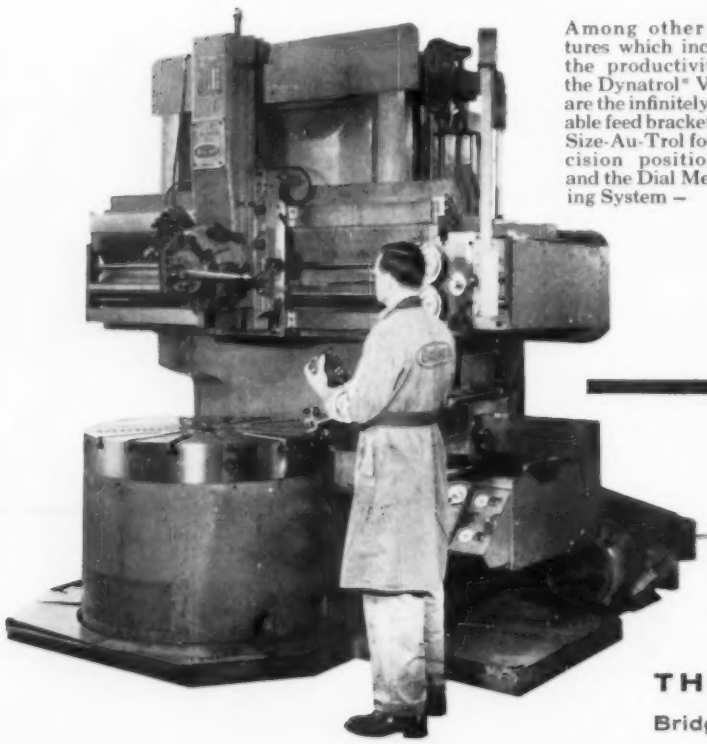
FINGER-TIP CONTROL

Increases Productivity of...

BULLARD

DYNATROL*
VERTICAL TURRET LATHES

Directional control of all head motions in feed on traverse, either horizontally, vertically or at any 45° angle, as well as table start and stop from a lightweight portable pendant, is a distinct production advantage.



Among other features which increase the productivity of the Dynatrol* V.T.L. are the infinitely variable feed bracket with Size-Au-Trol for precision positioning, and the Dial Measuring System –

It allows the operator to always be in the most advantageous position in relation to the work and eliminates the necessity of climbing for buttons or levers. By reducing operator fatigue and increasing his efficiency, more metal is removed per hour with a lower cost per piece.

*TRADE MARK

ask your Bullard Sales Engineer for the complete Dynatrol story or write for catalog.

THE BULLARD COMPANY
Bridgeport 9, Conn., Telephone EDison 6-2511

YOU CAN'T BEAT A BULLARD

Use Reader Service Card, CIRCLE 29

Metallurgical Memo from General Electric

Now you can throw your hones out the window!

General Electric announces...

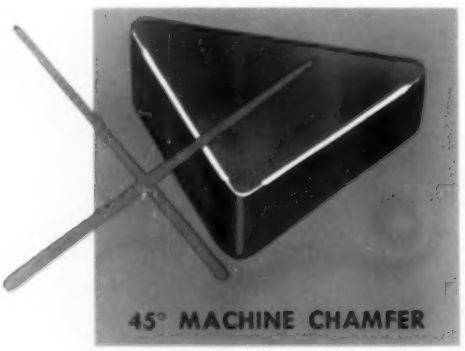
PRE-HONED CARBOLOY® INSERTS

delivered ready to use

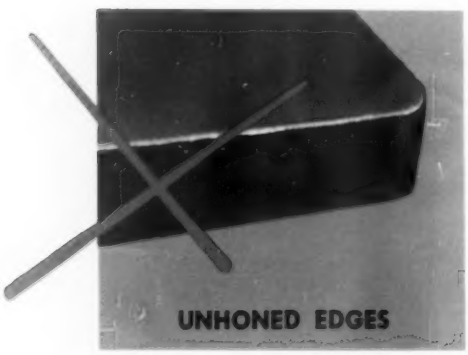
LOOK

Now you get more lower cost per cutting edge

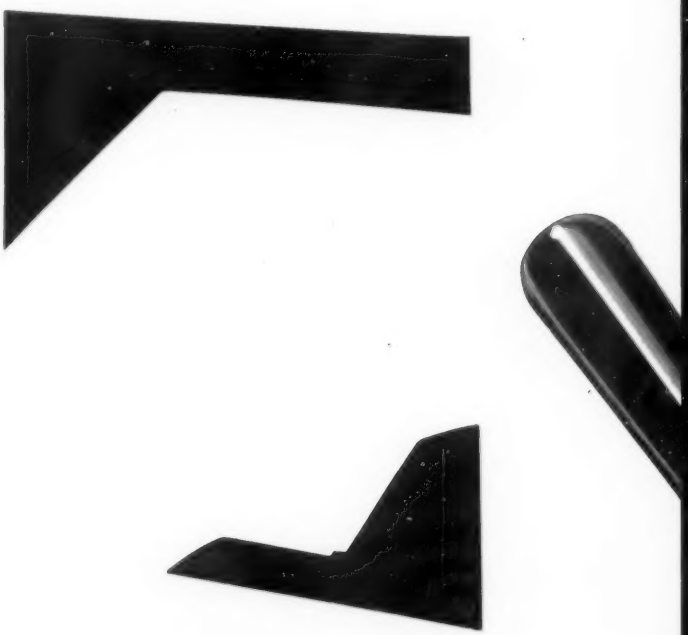
Hand-honing is inaccurate, time-consuming—often results in premature chipping and breaking.



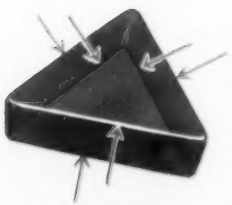
Chamfered, or ground-flat, edges are geometrically weaker than a radius and are more easily chipped or broken.



Unhoned or as-ground inserts show rough edges—result in unpredictable tool life due to chipping.



Pre-honed inserts with uniform, precise honed edges offer top strength; improve tool life predictability.



Because chipping and breaking are minimized, pre-honed Carboloy inserts result in lower cost per cutting edge.

Additional savings result through the elimination of costly and often inaccurate hand-honing methods.

predictable tool life...
...no hand-honing cost!

Delivered ready-to-use...
honed to a precise radius...
promise BETTER PROFITS
THROUGH BETTER TOOLING

Now General Electric Carboloy® inserts are pre-honed *at the factory!* Here's what it means to you:

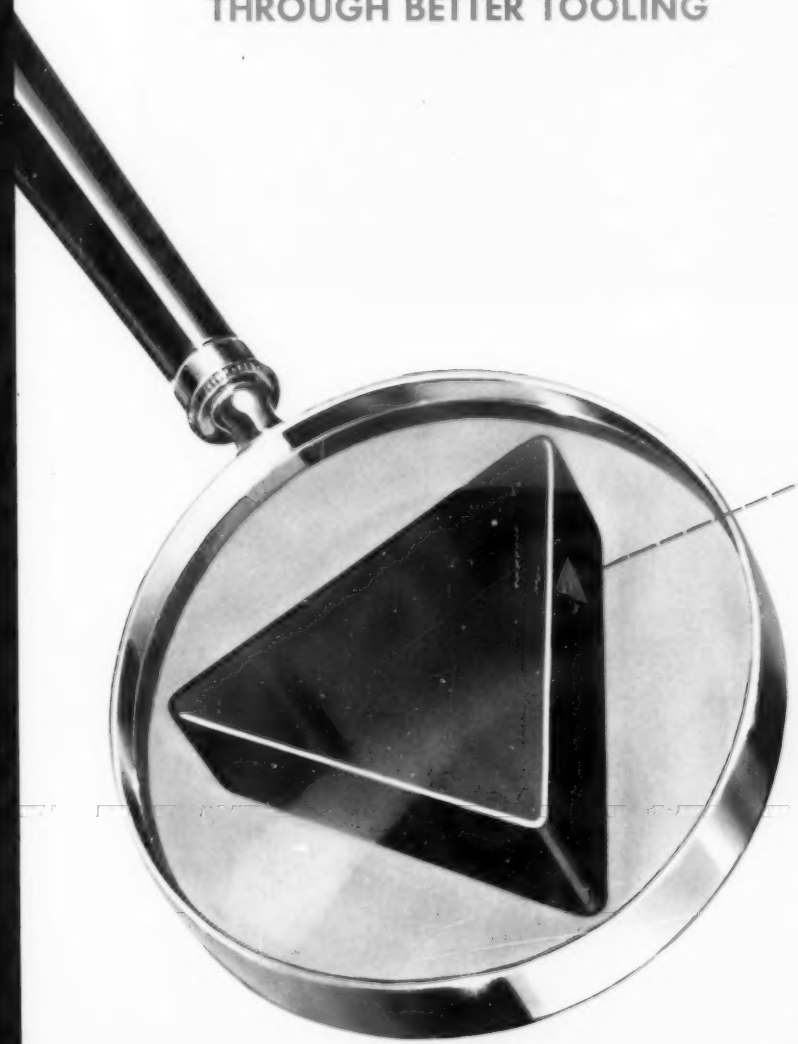
1. An insert with edges honed to precise *radii* gives the strongest geometric shape to withstand cutting pressures. This reduces the chance of chipping—increases the predictability of tool life. Hand honing *cannot* achieve precise radii—G-E pre-honing can . . . and does!

2. Since chipping is minimized, fewer cutting edges are wasted. The result is lower cost per cutting edge.

3. Since inserts come pre-honed and ready-to-use, the labor cost and inaccuracies of hand honing are eliminated. This more than offsets the additional charge for pre-honing.

4. Pre-honed Carboloy cemented carbide inserts have standard edge radii honed to a greater or lesser degree, depending on the job to be done. You'll *know* the honing is right!

Ask your Authorized Carboloy Distributor about pre-honed Carboloy inserts, convertible seats, toolholders, and brazed tools. Or, write directly to: *Metallurgical Products Department of General Electric Company, 11173 E. 8 Mile Road, Detroit 32, Michigan.*



Shown here, both under magnification and graphically, is an edge of the new Carboloy pre-honed insert. Radius is geometrically ideal to minimize chipping, extend tool life many times.

CARBOLOY®
CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

And the proof of the honing is in the saving!

Here's how the Dayton Steel Foundry Company uses Carboloy pre-honed inserts to machine cast steel truck wheels . . . at a savings!

Faced with increasing production, labor, and machining costs, the Dayton Steel Foundry Company had to economize without sacrificing quality.

A true, in-plant comparison between unhoned inserts and the new Carboloy pre-honed inserts was undertaken . . . and here's what happened:

Machining truck wheels of cast steel (AISI 1022 to 1032)—with a Brinell hardness of 140 to 190—required feeds from .015" to .019" per revolution; speeds from 280 to 320 fpm. Cuts varied from 1/8" to 3/8" and were interrupted on the O.D. turning of the spokes.

It was found that a pre-honed insert produced 85 pieces before it had to be indexed; showed wear only—*no chipping*. An ordinary unhoned insert produced only 40 pieces before *chipping and breaking*.

In *all* operations, it was reported pre-honed inserts provided 30% to 35% greater tool life over unhoned. Too, the need for hand-honing by the tool crib man has been eliminated—savings are estimated at 10c per insert, which more than offsets the additional cost of pre-honed blanks. Besides this, the tool man is freed for more productive work. Finally, the use of pre-honed inserts makes certain that no insert will get on the job without honing.

Make your goal "BETTER PROFITS THROUGH BETTER TOOLING"! Check with your Authorized Carboloy Distributor. He's listed in the Yellow Pages. *Metallurgical Products Department of General Electric Company, 11173 E. 8 Mile Road, Detroit 32, Mich.*

Tops in Tooling Quality

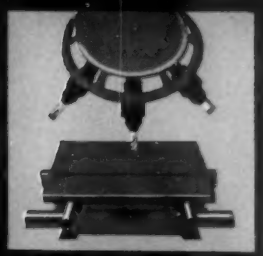
From the research and quality-control facilities of the Metallurgical Products Department of General Electric comes the outstanding quality tooling line in the metalworking industry. The new Carboloy pre-honed inserts, as well as the complete line of Carboloy toolholders, inserts, insert seats, convertible seats, and brazed tooling, are designed to meet every tooling need efficiently and economically.

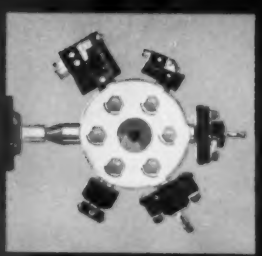
CARBOLOY
CEMENTED CARBIDES

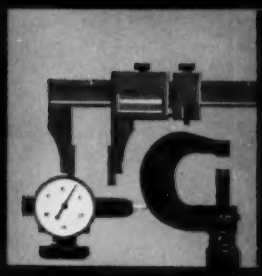
METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

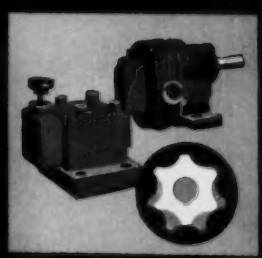
CARBOLOY® CEMENTED CARBIDES
MAN-MADE DIAMONDS • MAGNETIC MATERIALS
THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS







to help you make more for less



Brown & Sharpe

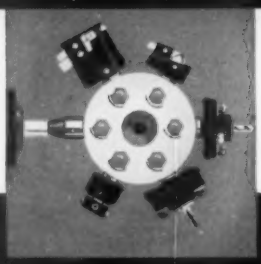
PRECISION CENTER

MMT-PE

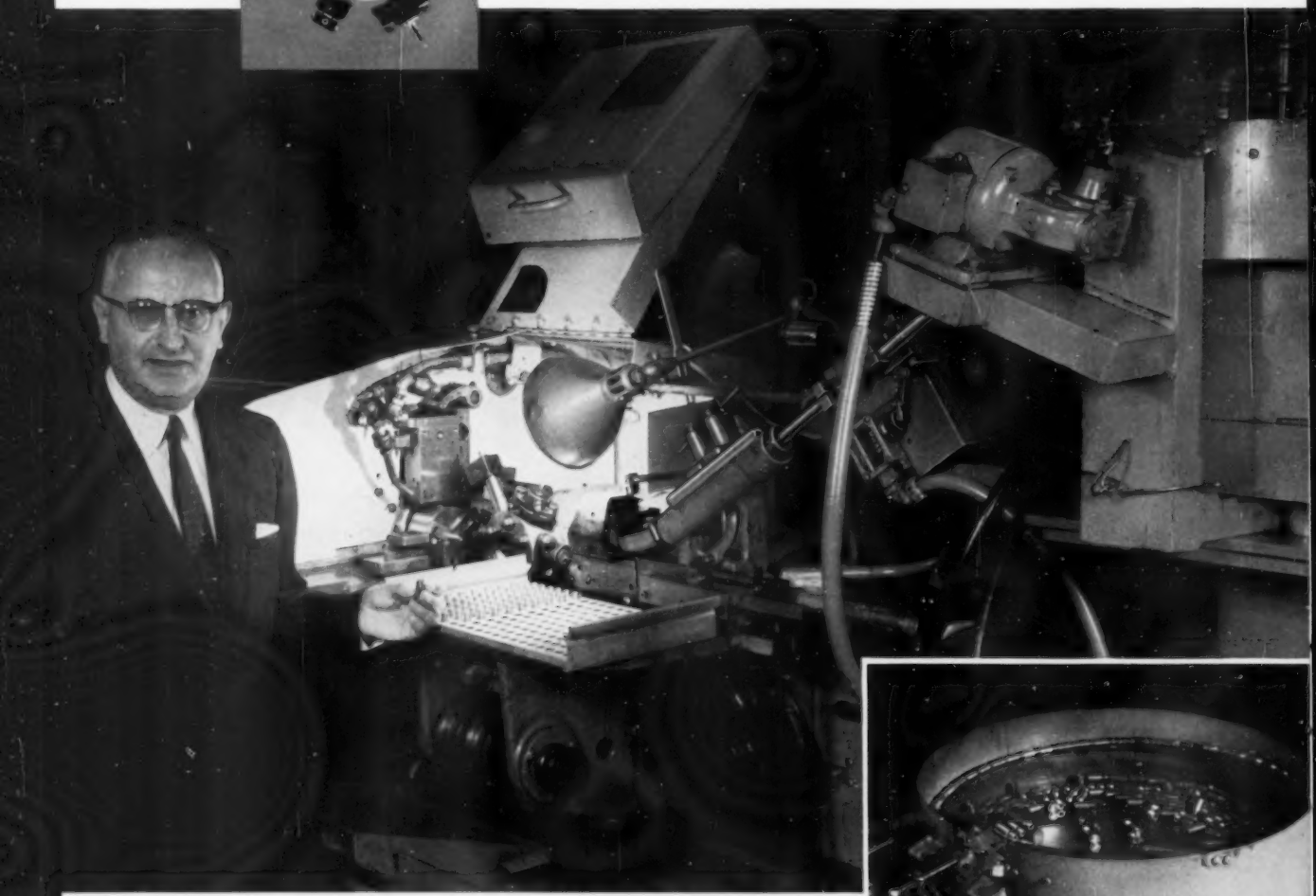
MACHINE TOOL
EXPOSITION
BOOTH 452

MMT·PE

Booth 452
Machine Tool
Exposition



TO HELP YOU REDUCE
SCREW MACHINE PRODUCTION COSTS



Parts are delivered in continuous flow through tube from hopper to spring-loaded bushing mounted in one port of turret. Bushing carries part 180° and delivers it to opened Skinner Chuck in spindle, where it is held for operation cycle.

Eliminates manual loading–reduces cycle time 10% with Brown & Sharpe Automatic Turret Loading Arrangement

"Our second operation net production compares favorably, with bar work on machines with automatic bar loading," says Cornelius M. Woog, Manager of Manufacturing Engineering; The Skinner Chuck Company and Skinner Electric Valve Division. "The B&S Hopper Feeder eliminates the disadvantages of cross slide chute loading."

Hopper feeding is fully automatic, with a big saving in operators' time. The customary interference allowance is eliminated. On some jobs, the time required for other loading methods can be reduced 50%.

More operations can be performed in a shorter time cycle, since both cross slides, and for most work, five turret ports are available for tooling. For the job illustrated, the cycle time saving was 10%.

The Brown & Sharpe Automatic Turret Loader is a standard, self-contained unit, readily adaptable to a variety of work. Change-over usually takes less than 30 minutes.

For use with B&S No. 2 Automatics, the arrangement takes work up to 1¼" diameter and 4¼" length. Models for other sizes of B&S Automatics will be available soon.

Send samples and prints for application study and report of your potential savings on second operation costs. Write: Machine Tool Division, Brown & Sharpe Mfg. Company, Providence 1, Rhode Island.

Brown & Sharpe PRECISION CENTER

Use Reader Service Card, CIRCLE 31

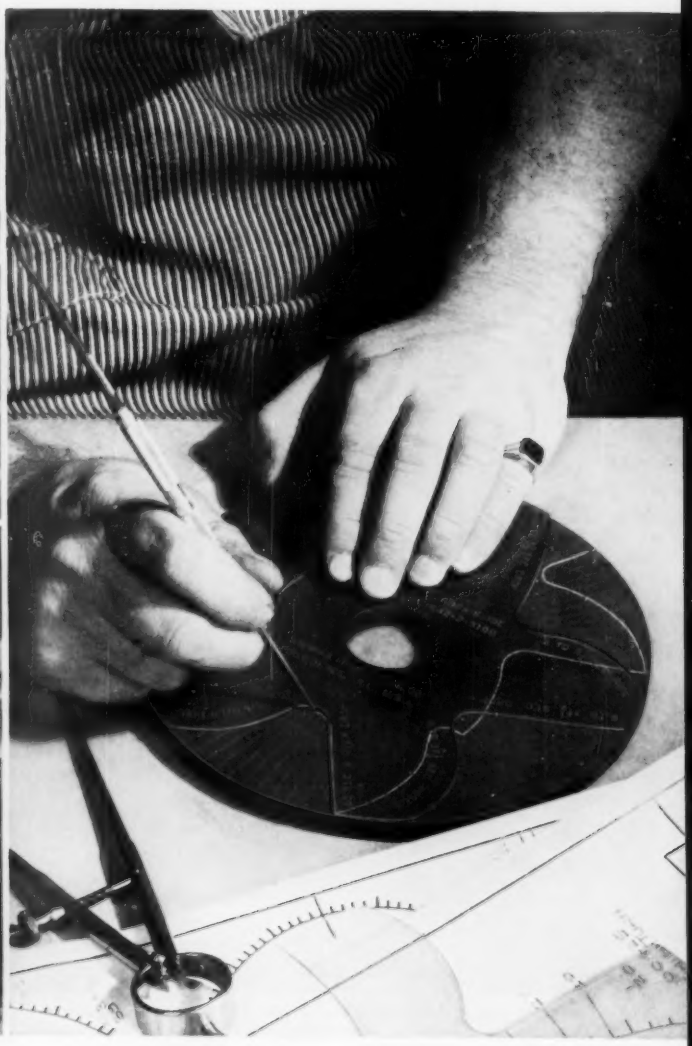
MMT·PE

Booth 452
Machine Tool
Exposition

MMT-PE

Booth 452
Machine Tool
Exposition

TO HELP YOU GET MORE FROM MACHINE TOOLS



3 new time-savers from Brown & Sharpe's complete accessory and screw machine tool line

1. New Brown & Sharpe Perma-Clamps make it easy to clamp non-magnetic work on magnetic chucks. Slightly raised, spring-mounted jaws are just placed against each side of the work. They are pulled down, to wedge the work tightly between them, when the chuck is turned on.

2. New B&S Adjustable Knurl Holder No. 185 with its exclusive quick-change feature saves you up to 15 minutes' time when changing or adjusting knurls. New capacity allows more work to be done with existing machines.

3. New B&S pre-colored cam blanks save up to 75¢-worth of preparation time per blank. They're ready for instant layout; there is no de-greasing, dyeing or drying.

Brown & Sharpe is constantly coming up with new ideas in tooling — to help you get more, for less, from your machines. Be sure you have the latest cost-saving information on this complete line. Write for Machine Shop Accessories Catalog 37A and Screw Machine Tool Catalog 37S. Brown & Sharpe Manufacturing Company, Providence 1, Rhode Island.

Visit our Booth No. 452 at the Machine Tool Exposition in September

Brown & Sharpe PRECISION CENTER

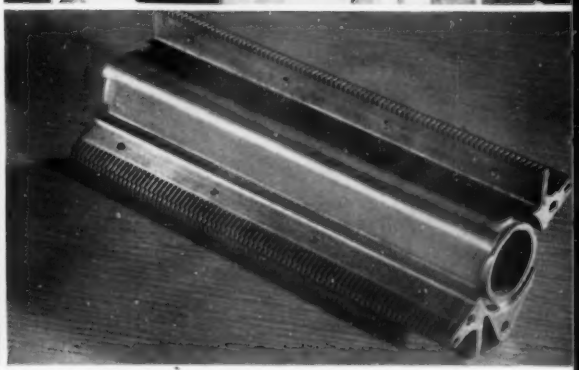
Use Reader Service Card, CIRCLE 32

MMT-PE

MMT-PE

Booth 452
Machine Tool
Exposition

TO HELP YOU MILL MORE FOR LESS



International Business Machines Corporation has steadily increased installations of B&S No. 12 Plain Milling Machines, based on a 20-year experience. Department managers rely on their easy adaptability to the wide variety of work machined, and the exclusive features which permit safe, fast climb-milling cuts to the close tolerances and surface quality essential in parts for IBM products.

No. 12 installations at the Endicott plant include — (left) a production line of 3 HP machines, and (upper right) a 7½ HP machine. The part shown, with 80 slots in four rows, is typical of many complex shapes produced by climb milling, with high efficiency, in simple fixtures.

At IBM - climb-milling efficiency of B&S No. 12 speeds production - meets high precision standards

Climb-milling in either direction — to full overload capacity — is completely safe on the No. 12 Plain Milling Machine. With the B&S backlash eliminator, milling setups can take full advantage of the extra high cutting loads now practicable with high speed and carbide cutters, without risk of damage.

You can make full utilization of the wide choice of milling cycles provided. Thin, narrow, or irregular shapes can be held in simple fixtures, and climb milled with maximum feeds.

All the operating features you need for fully automatic milling are standard in the B&S No. 12. With special fixtures, you can get the productivity of an expensive, single-purpose machine. Your investment is lower, and you retain the unlimited adaptability of the basic machine. It can easily be converted for revised operations or other jobs.

Brown & Sharpe milling specialists will survey your operations and show you how to get the most production per dollar invested. For complete information, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.

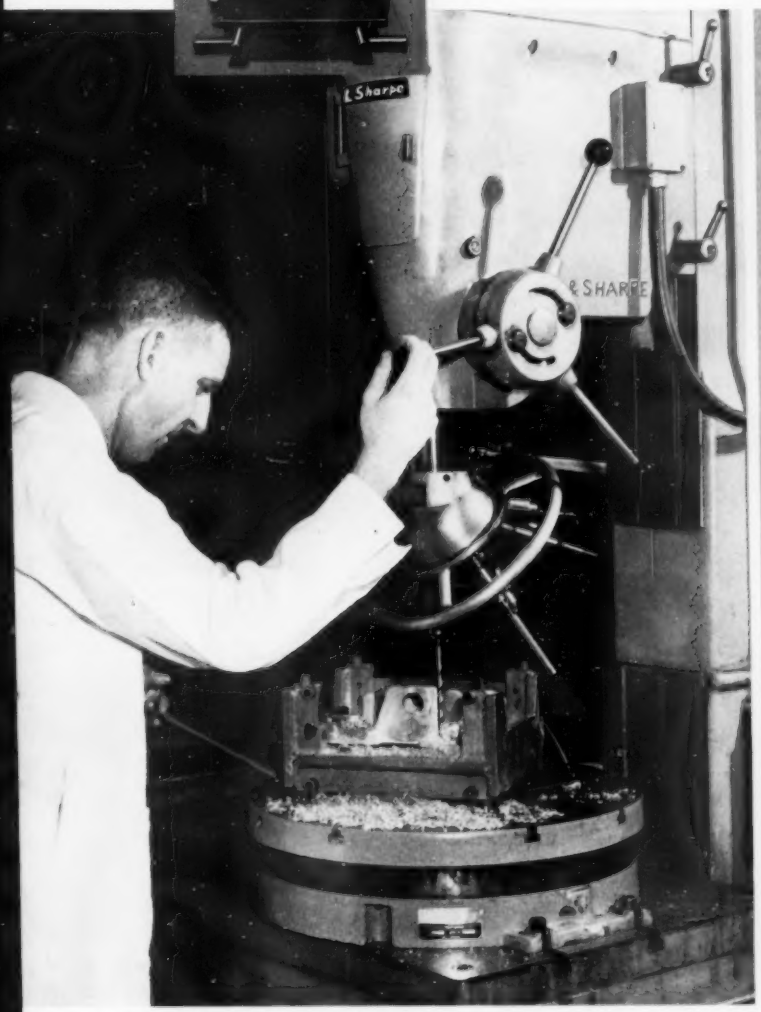
Brown & Sharpe PRECISION CENTER

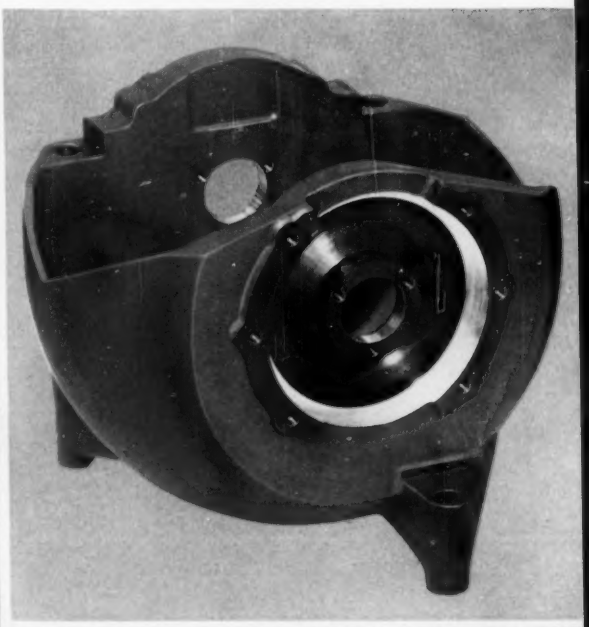
Use Reader Service Card, CIRCLE 33

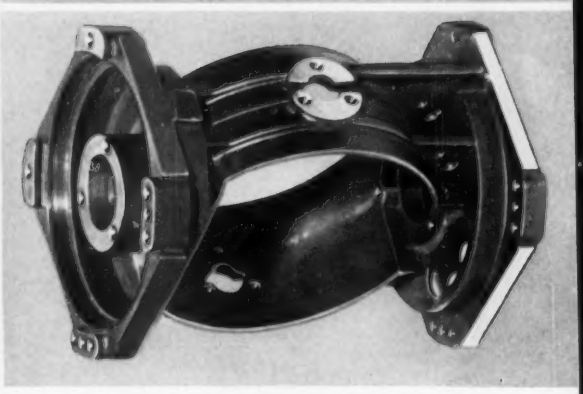
MMT-PE

Booth 452
Machine Tool
Exposition

TURRET DRILLING MACHINES...
TO HELP YOU DRILL MORE FOR LESS







AT WALTHAM PRECISION INSTRUMENTS CO., the base casting for a missile timing mechanism, shown in fixture mounted on B&S Positioning Table, is one of many parts machined to close tolerances with B&S Turret Drilling. Two other parts illustrate typical precision hole patterns.

In the aluminum outer gimbal for a Waltham Vertical Gyroscope (upper right) 27 drilling, tapping, and reaming operations are performed in 15 holes, in 3 planes. In the steel inner gimbal (lower right) 61 drilling and tapping operations are performed in 33 holes in 5 planes.

Instrument maker gets .001" hole locating precision– 60% time saving–with Brown & Sharpe Turret Drilling

Drilling, tapping, boring, and reaming account for a big percentage of the machining costs at Waltham Precision Instruments Co., Massachusetts manufacturer of timing devices, missile components, and other precision electro-mechanical products. Compact design calls for machining complex patterns of accurately spaced, small diameter holes.

With drilling operations a prime target for cost-reduction, Waltham makes good use of the big savings potential of the B&S Turret Drilling method. Multiple operations are performed at a single station. With the B&S Positioning Table and simple holding fixtures, accurate hole location (within .001") takes only a few seconds in each sequence. Production time is up to 200% faster than with gang-drill box jig methods.

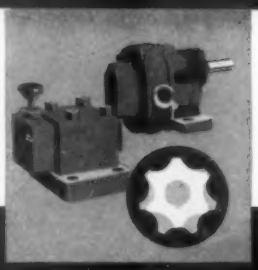
Find out how much you can save with Brown & Sharpe Turret Drilling Machines—in work transfer and set-up time, in jig costs, in tool wear and maintenance—in capital investment and floor space. Write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Brown & Sharpe 1833 PRECISION CENTER

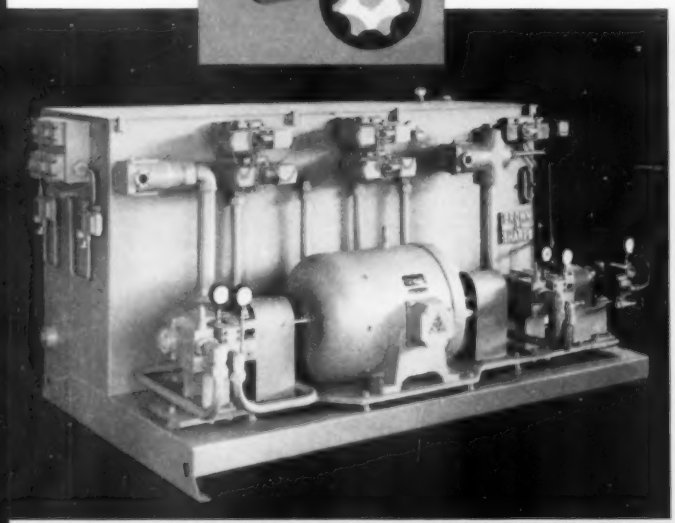
Use Reader Service Card, CIRCLE 34

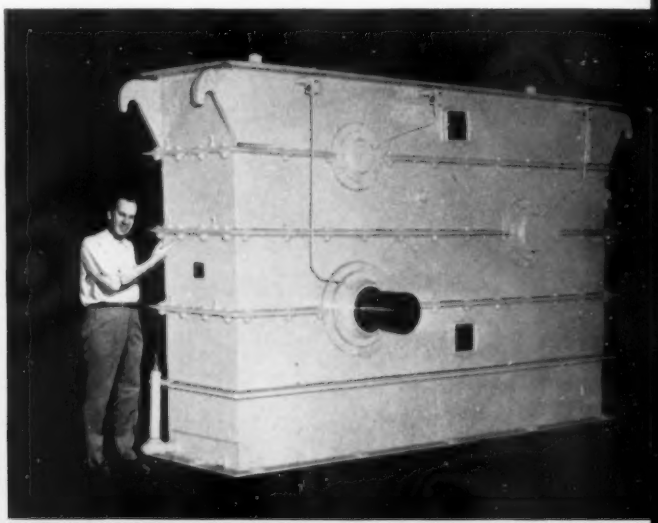
MMT-PE

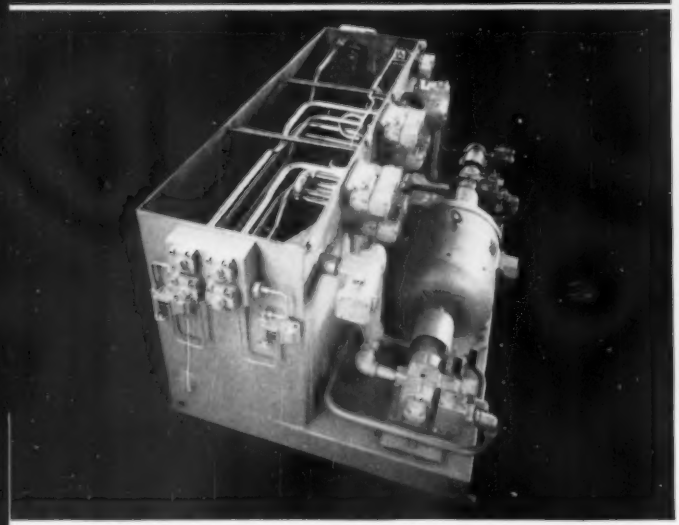
Booth 452
Machine Tool
Exposition

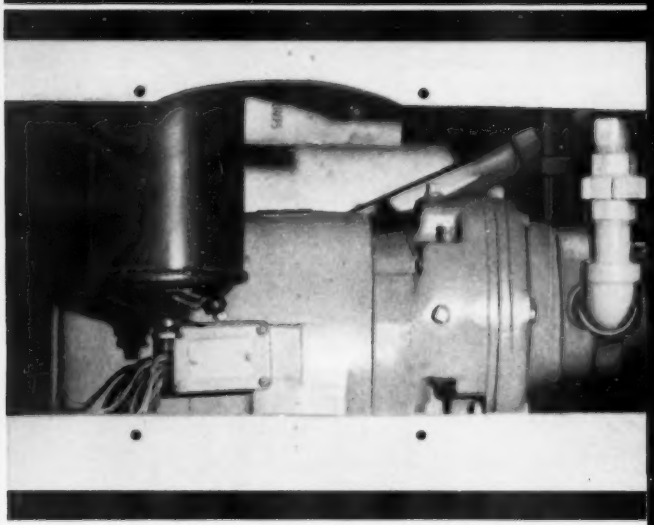


TO HELP YOU HANDLE FLUIDS MORE EFFICIENTLY... AND FOR LESS









New Circuit Master comes pre-assembled to suit your needs. Components and fluid are easily inspected — additions easily made.

Morse Chain transmission (above) will connect 758 hp engine to big flood-control pump. B&S No. 113 pump (below) lubricates transmission.

Double A announces economical new "package" for hydraulic power

This "Circuit Master" is a compact new hydraulic power unit that combines required motor, pumps, valves, reservoir and other components in a money-saving, L-shaped design.

It is economically pre-assembled of "stock" items by one responsible source — Double A. It reduces your external piping as much as 40%, and is easy to maintain.

Write for details on Circuit Master and the complete line of Double A hydraulic power units, control valves, Gerotor pumps. Double A Products Co., subsidiary of Brown & Sharpe Mfg. Co., Manchester, Michigan.

B&S Pumps help make good land out of bad in Florida swamps

Morse Chain Co. designers needed dependable, motor driven gear pumps to lubricate heavy chains, sprockets and bearings in four king-sized transmissions they are furnishing for a flood control and irrigation project.

They found their pumps on Page 29 in the Brown & Sharpe pump catalog, available for immediate delivery.

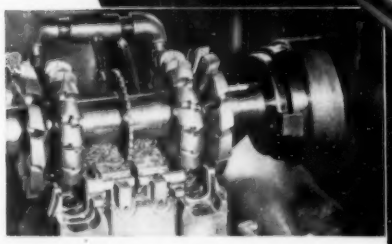
Simplify your own pump problems by writing for and using the B&S Catalog, No. 36P. Brown and Sharpe makes more pumps for more fluids than any other manufacturer! Brown & Sharpe Mfg. Co., Providence 1, R. I.

Visit our Booth No. 452 at the Machine Tool Exposition in September.

Brown & Sharpe PRECISION CENTER

Use Reader Service Card, CIRCLE 35

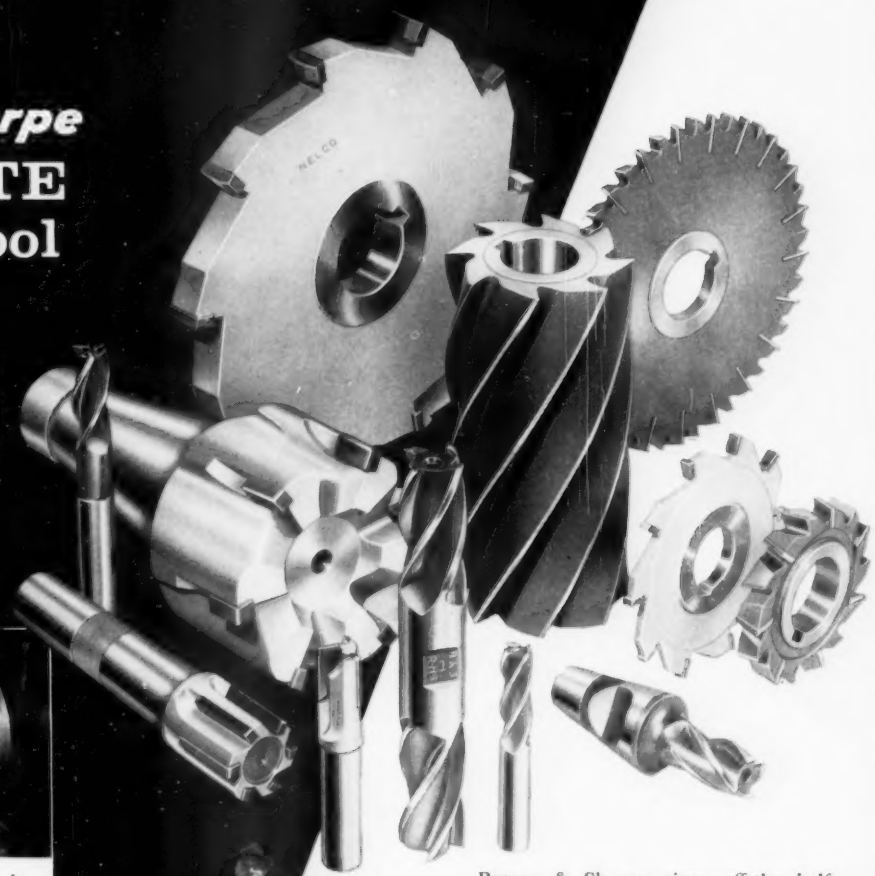
How *Brown & Sharpe* COMPLETE Cutting Tool Service Gives You EXTRAS!



Brown & Sharpe experience in "Special" milling cutter design and engineering is the result of manufacturing millions of "specials" over the past 125 years.

Brown & Sharpe Cutter Service Shops, through Distributors, give on-the-spot resharpening, repair and modification service with speed and economy!

Brown & Sharpe offers a line of reusable, sturdy packages, easy to stock, easy to ship . . . excellent protection for the *best* in cutting tools!



Brown & Sharpe gives off-the-shelf service from the World's Largest Line of High Speed, Carbide and Carbide Tipped Milling Cutters!

Brown & Sharpe has experienced Cutting Tool Engineers available everywhere to solve tough production problems in your shop quickly, efficiently!

Brown & Sharpe complete cutting tool service is available through dependable Industrial Distributors everywhere in Metalworking America!

Brown & Sharpe has a NEW line of Cutting Tool Catalogs with complete Engineering Data. Information on *every* B&S Tool includes:

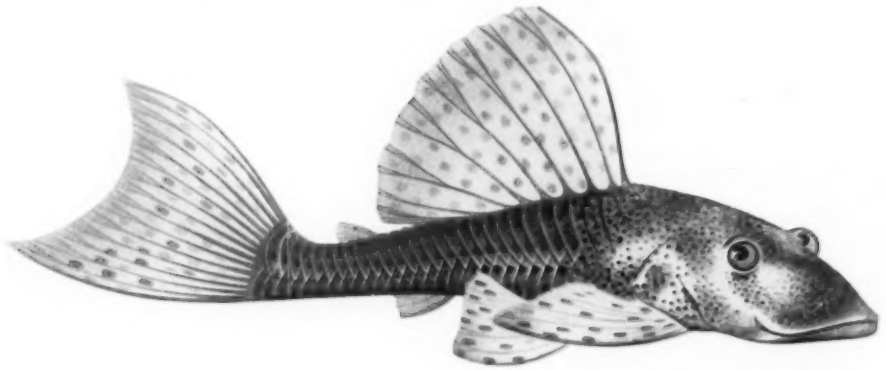
PRODUCTION USE MATERIALS TO BE CUT TOOL FEATURES TOLERANCES TOOL DESIGN

Take the guesswork out of tool selection. Request your catalogs today . . . and, for EXTRAS, specify B&S Milling Cutters!

Brown & Sharpe — HIGH SPEED STEEL CUTTING TOOLS

NELCO — CARBIDE CUTTING TOOLS

To identify a strange fish...



you call in an *ICHTHYOLOGIST*

(specialist in fish life)

Dean Strand solved an unusually

Dean Strand's many years as an Abrasive Specialist and a salesman for machinery that uses grinding wheels have covered most of the problems in the book. That's why he so often finds practical solutions that are *not* in the book.

PROBLEM – An unusual grinding problem faced Illinois Tool Works, Chicago, when they began manufacturing a special steel gear shaper cutter. They required a grinding wheel that would generate an involute curve on the sides of the gear shaper cutter teeth, grinding with the side instead of the periphery of the wheel.

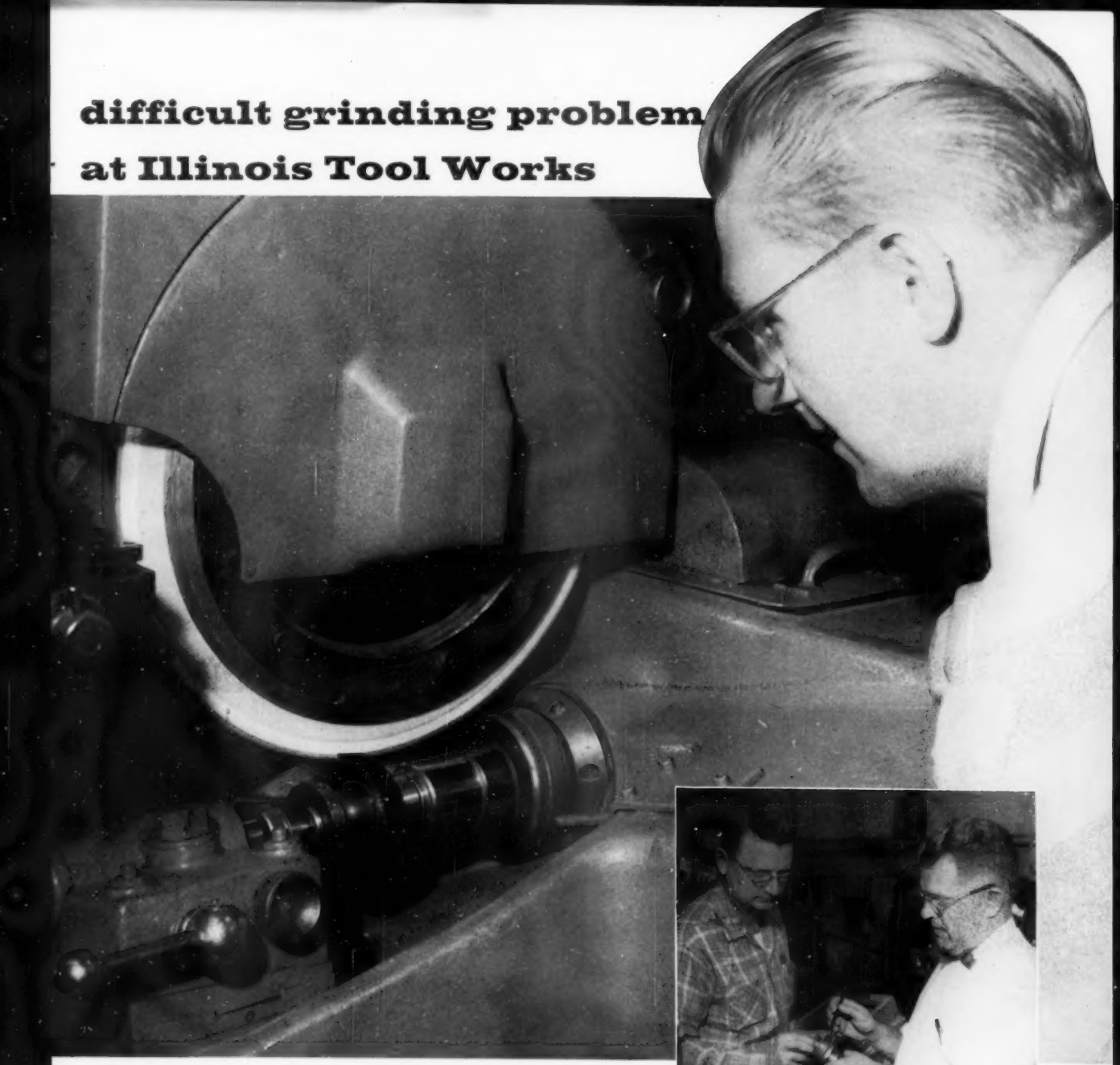
In attempting this grinding operation with competitive wheels, production was delayed by the wheels breaking down, glazing or mutilating the gear-teeth walls. It was impossible to maintain the involute shape of the teeth within specified accuracies.

SOLUTION – Bay State Abrasive Specialist Dean Strand was called in and went over every detail of the operation. He recommended a 16" diameter x 5/8" thick wheel with a highly friable aluminum oxide abrasive and a special Bay State vitrified bond modification, on Illinois Tool's gear-shaper-cutter grinding machine.

RESULT – No further problems on this gear finishing application! The wheel consistently maintains accuracies to within 1/10,000-inch and, in the words of Illinois Tool's Process Engineer Ed Leighton, "we wanted a wheel that would grind without glazing, that would stand up under these unique conditions, that would give us reasonable wheel life and would enable us to get real *production* out of our machine. Well, thanks to Dean Strand, we've got it."

Like Dean Strand, the Bay State Abrasive Engineer in your area is a trained expert. He backs up the work of the experienced men who represent Bay State's topflight distributors; and Bay State's research labs back them both with new ideas, techniques and materials. *Better grinding at lower cost . . . that is our business.*

difficult grinding problem at Illinois Tool Works



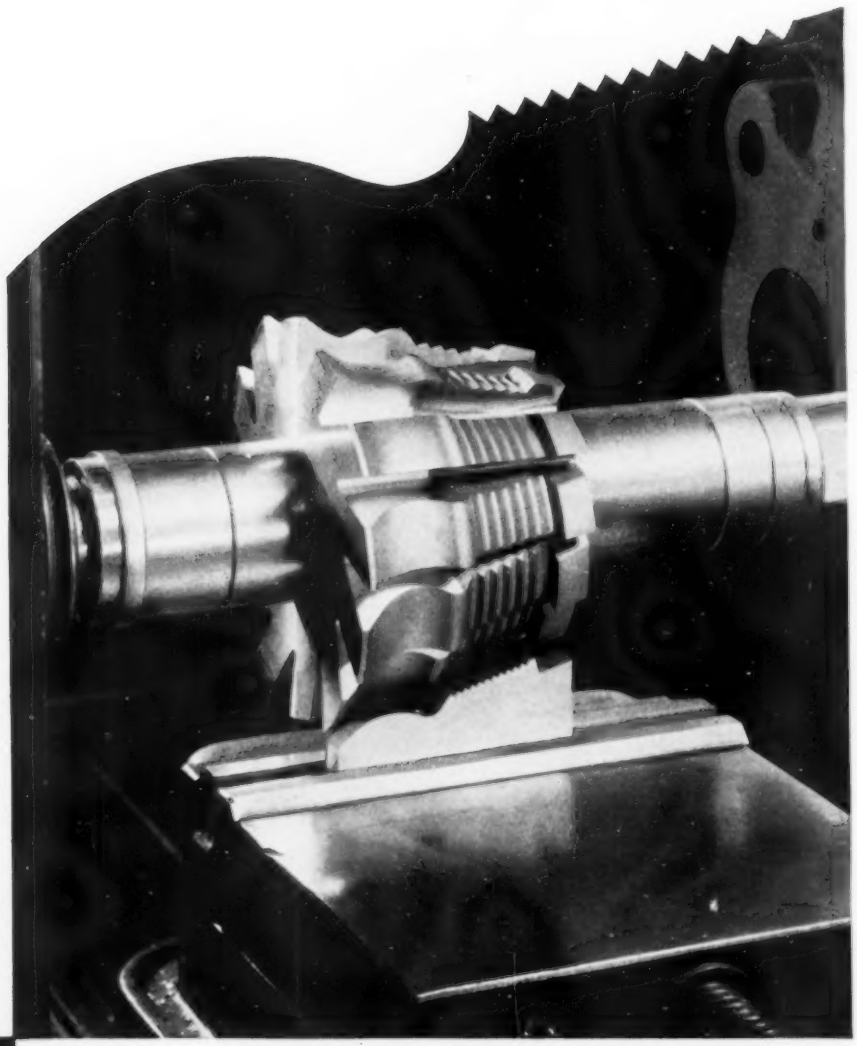
(*Above*) Operator Dale Jackson at his gear-shaper cutter-grinder equipped with a Bay State 16 x 5/8-inch aluminum oxide abrasive wheel. Grinding is done by side of wheel instead of face. 1/10,000" accuracy is consistently maintained.

(*Right*) Process Engineer Ed Leighton and Inspector Leroy Wegner, of Illinois Tool Works, checking the tooth angle on a gear-shaper cutter. Extreme accuracy of the helical lead, and its involute shape, are vital to the completed product.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.



Cutters with built-in Efficiency and Accuracy

This is an example of how efficiency and accuracy can be designed right into the cutting tool. The manufacturing and engineering capabilities of Barber-Colman Company can be added to your own in finding better solutions to milling problems.

The form shown at the left of the part is milled at the same time the multiple serrations are cut. Milling sharp points on the serrations is made possible by the alternate tooth design (see photo, above). The cutter is shown milling a sample which is later projected against an enlarged layout of the part to assure that the cutter will produce within specified tolerances. But, some of the most important quality features of this cutter are not visible to the naked eye.

Unground form . . .

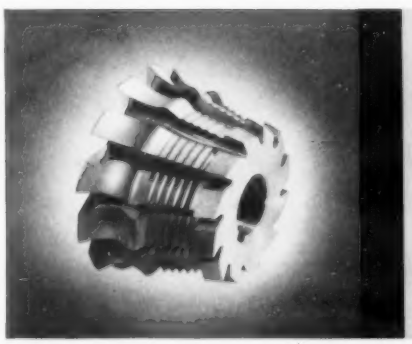
Ability to combine complex tool geometry and accuracy in this cutter without form grinding reduces original cost. In addition to greater accuracy, you get longer tool life from a cutter that is metallurgically as well as geometrically well formed. Barber-Colman's individual processing in the most modern metallurgical lab and heat-treating department assures highest quality which can be tested by the number of high-quality parts manufactured for every dollar of cost.

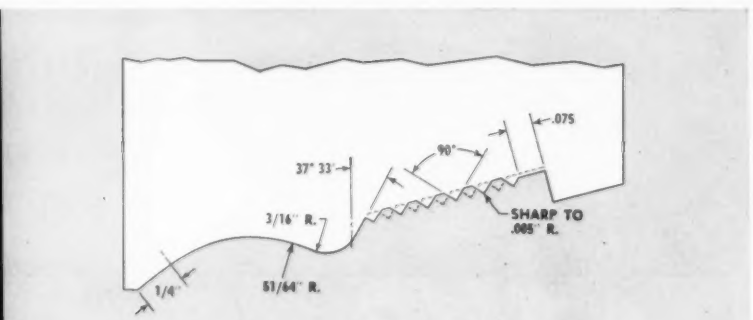
Sharpening economies . . .

Additional savings result from Barber-Colman's exclusive design and manufacturing techniques. For example,

Mill Odd Shapes in One Operation

...with Barber-Colman Form-Relieved Cutters





the smooth finish on the tops and sides of the teeth eliminates rough edges — a common cause of breakdown on the flanks. Faces are index-sharpened, permitting the important economy of *automatic resharpening*. Your sharpening guide or an automatic sharpener will maintain original accuracy throughout the life of the cutter.

These economies reduce the most important elements of tool cost: the cost of scrap and rework, cost of sharpening, cost of downtime for tool changes, and cost of tool depreciation.

Five types of engineering...

You get more than a cutting tool when you buy "Barber-Colman." You get five types of specialized engineering that reduce your costs and upgrade your quality:

1. *Application engineering* — on-the-spot evaluation of milling problems by experienced tool designers.
2. *Design engineering* — highly specialized tool engineering, backed by electronic computer facilities for fast, accurate calculation of complex forms.
3. *Metallurgical engineering* — specially selected steels and heat treatment for your particular material and tool geometry.
4. *Manufacturing* — the most complete and advanced processes under one roof for producing exactly the right finish, highest accuracy, and *any* cutter style.
5. *Quality control* — optical master inspection, seven different control stations, and numerous separate inspections for individual cutters.

Whether you want to combine operations, change processes, or just get more out of your tooling dollar, you can have a Barber-Colman field engineer at your desk for consultation by just calling Rockford — TR 7-5741.

Barber-Colman Company

BARBER COLMAN

63 Loomis Street, Rockford, Illinois

THIS INTRICATE 3-DIMENSIONAL DESIGN WAS MILLED

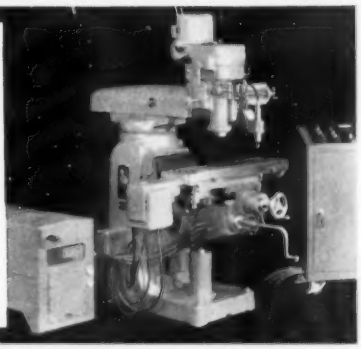
AUTOMATICALLY

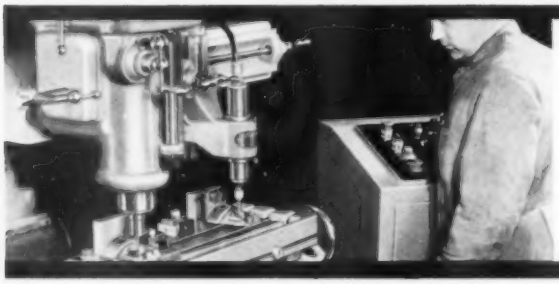
ON A GORTON

180°

Fully Automatic

AUTO-TRACE DUPLICATOR





NO MANUAL GUIDANCE BY OPERATOR REQUIRED

Numerical Control Benefits at The Low Cost of **GORTON** Automatic Tracing

This new concept in automation duplicates numerical control results in many instances . . . at much lower cost. Complex shapes can be quickly machined, at tolerances and feed rates never before possible. Human error and resultant scrap, are eliminated, and the machine quickly pays back its moderate cost.

The new GORTON 180° Auto-Trace combines instantaneous electronic tracing response with smooth, positive hydraulic feeds. Exclusive features include all-new, completely integrated, built-in automatic tracing system; dual-purpose deflection meter; increment cross-feed; automatic, coordinated feed; area and plateau controls . . . plus special attachments that increase versatility and efficiency. If you have a machining problem which calls for numerical control benefits and for completely operator-free automatic production, it will pay you to investigate this new Gorton Auto-Trace electro-hydraulic 180° Duplicator. Write for Bulletin 2968.

MMT-PE MACHINE TOOL EXPOSITION 1960

If interested in completely automatic 360° production profiling on the same type of machine described here, write for Bulletin 2972.

GORTON SINCE 1893

GEORGE GORTON MACHINE CO.

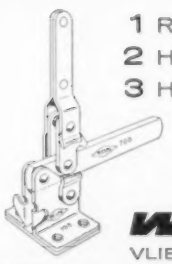
2606 Racine St. • Racine, Wisconsin

Milling, Die Sinking, Profiling and Engraving Machines with Manual Hydraulic, Electro-Hydraulic or Numerical Guidance Systems. Special Machines and Automated Transfer or Indexing Machines. Cutting Tools and accessories . . . Defense and special products.

There's a WESPO clamp or plier for every clamping job!

80 models and sizes...

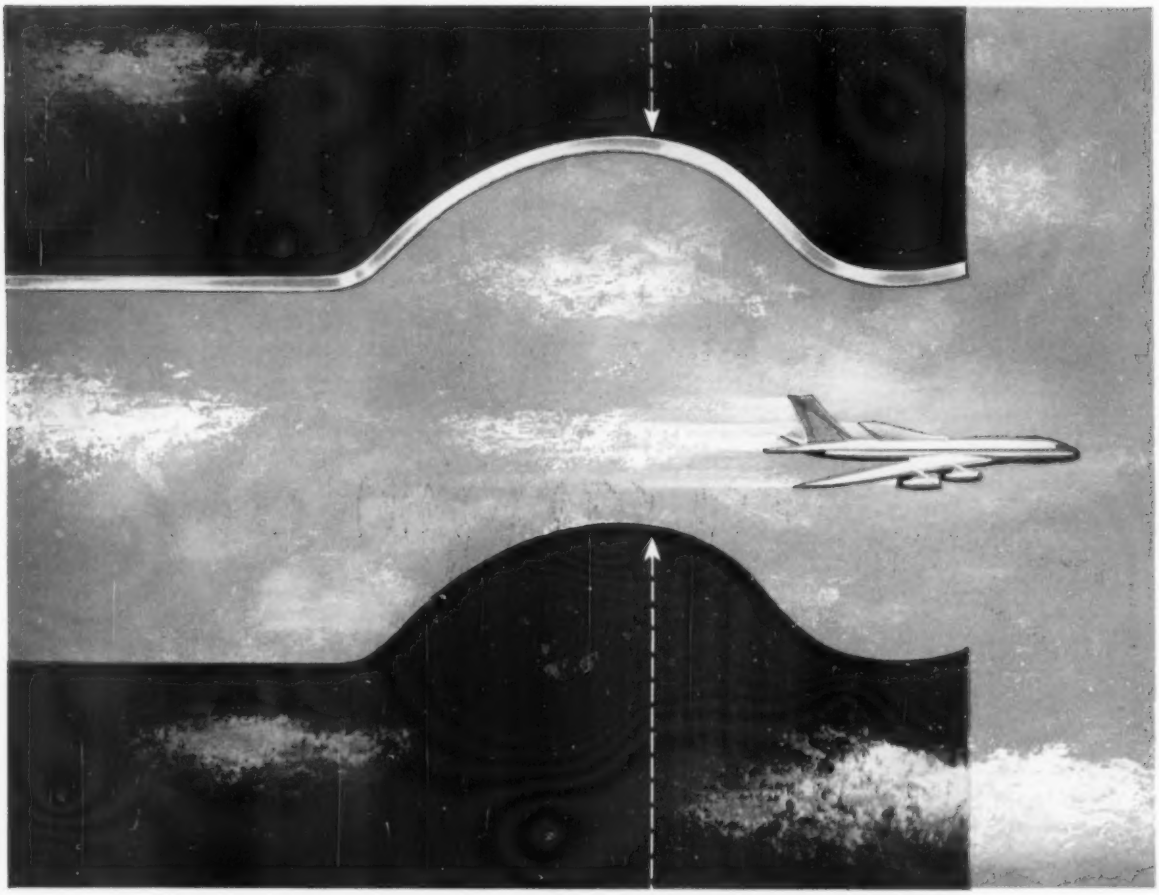
made better three ways to give more positive holding, last longer!



1 Reamed holes
2 Hardened serrated bushings
3 High tensile strength rivets

send for free catalogs describing Wespo clamps and fixture details

WESPO *DIVISION*
VLIER ENGINEERING CORPORATION
Formerly West Point Manufacturing Company
26935 W. Seven Mile Road • Detroit 19, Michigan



Want to save with plastic tools and dies?

Your EPON® RESIN tooling formulator can help you

Tools and dies made of tough but easy-to-handle Epon resin can save you up to two thirds in time, one third in cost! Your tooling resin formulator will show you how Epon resin formulations are saving time and money—*right now*—in applications such as:

High-temperature tooling: Metal-forming stretch dies that can operate at temperatures over 400° F.

Heated tools: Matched dies, with integral heating units, may be made with Epon resin formulations for rapid heat-curing of laminated plastic parts.

Long-lasting metal-forming tools: Castings made of formulated Epon resin, mounted in a crank press, showed no permanent deformation after 28,000 compression-shock cycles.

For tool and die applications, Epon resin formulations offer you the following important advantages:

Excellent tolerance control: Little machining and handwork are required to finish Epon resin tools because of the material's excellent dimensional stability and lack of shrinkage.

Outstanding strength: Jigs and fixtures with thin cross sections can be built from Epon resin-based formulations reinforced with glass cloth. The resulting laminate has high flexural strength and excellent dimensional stability.

Easy modification: Tools and fixtures made from Epon resins may be quickly and easily modified to incorporate design changes.

CONTACT YOUR TOOLING RESIN FORMULATOR

The combination of resin formulator's skill and application knowledge, backed by Shell Chemical's research and resin experience, has solved many important tooling problems for industry. For a list of experienced tooling resin formulators and additional technical information, write to:

SHELL CHEMICAL COMPANY
PLASTICS AND RESINS DIVISION
110 WEST 51ST STREET, NEW YORK 20, NEW YORK

Central District	East Central District	Eastern District	Western District
6054 West Touhy Avenue	20575 Center Ridge Road	42-76 Main Street	10642 Downey Avenue
Chicago 48, Illinois	Cleveland 16, Ohio	Flushing 55, New York	Downey, California

IN CANADA: Chemical Division, Shell Oil Company of Canada, Limited, Toronto

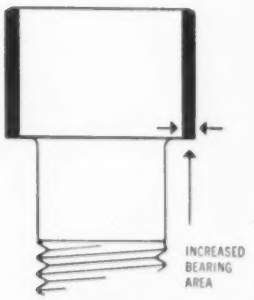
SHELL

Up to 2⅓ times as much holding power!

Up to 100% longer fatigue life!

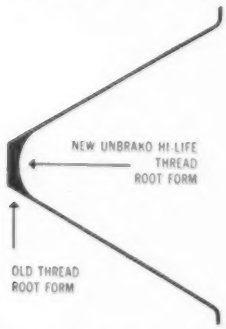
New UNBRAKO *pHd** Hi-Life socket screws increase mechanical reliability of your assemblies without increasing production costs

Stronger in the head



New pHd head features increased bearing area, more powerful wrenching socket; provides up to 2⅓ times as much clamping force without indenting bolted material. This permits higher preloading, which in turn helps prevent fatigue failures or loosening under vibration.

Stronger in the thread



Smoothly radiused root of new Hi-Life thread distributes stress concentrations at point where 85% of screw failures occur, practically doubles fatigue life. New thread—exclusive with UNBRAKO—fits standard tapped holes and nuts, requires no special gaging or assembly techniques.

Here is the one new socket head cap screw that is redesigned *throughout*. UNBRAKO pHd Hi-Life is the only standard socket screw offering you both the new, larger pHd head (1960 Series) *and* new UNBRAKO Hi-Life thread.

Because of increased bearing area under the head, you can tighten a pHd Hi-Life tighter without indenting bolted material. This safeguards vital preload; protects against loosening under shock or vibration. At the same time, the new Hi-Life thread form drastically reduces stress concentrations at the root, where most screw failures occur. Result: up to 100% increase in fatigue life.

Both the pHd head and Hi-Life thread originated in the SPS laboratories for advanced fastener research where they were first developed for ultra-high-strength aircraft bolts. Recognizing the critical need for greater mechanical reliability in industrial and consumer goods as well, SPS now offers these refinements in a standard commercial fastener.

New UNBRAKO pHd Hi-Life socket screws are available to you immediately in sizes ¼ through 1 inch, plain or cadmium plated, with or without the Nylok† self-locking feature. They cost no more, require no change in assembly or gaging procedures. See your authorized UNBRAKO distributor or write SPS—manufacturer of precision threaded fasteners and allied products in many metals, including titanium. Request Bulletins 2406, 2577.

†T.M. Reg. U.S. Pat. Off., The Nylok Corp.

TENSION-TENSION FATIGUE TESTS PROVE LONGER FATIGUE LIFE OF UNBRAKO HI-LIFE THREAD FORM

Screw Size: ½-20 Testing Speed: 1050 cpm

Alternating Stress in psi (000 omitted)	Cycle Life: Old Thread Root Form	Cycle Life: UNBRAKO Hi-Life Threads
2-20	2,076,000	8,000,000*
3-30	598,000	1,808,000
4-40	120,700	232,350
5-50	56,650	89,950
7-70	22,900	40,000

*Test stopped—no failure

INDUSTRIAL FASTENER Division

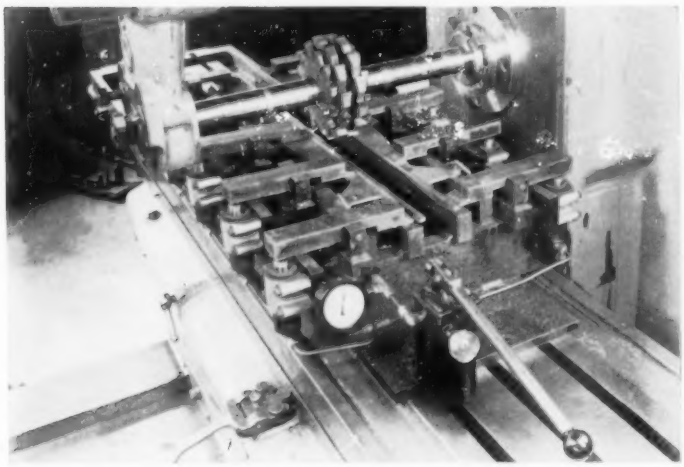
JENKINTOWN 37, PENNSYLVANIA

SPS

where reliability replaces probability

*pHd stands for "proper head design"—a factor in higher product reliability

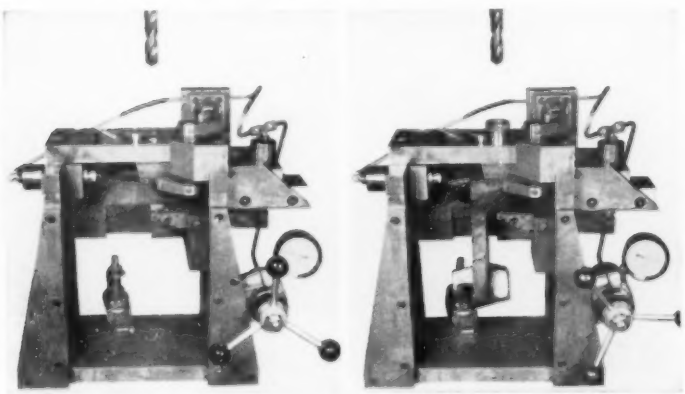
How other shops clamp down on loading time...



TRIANGLE PACKAGE BOOSTS PRODUCTION 335% . . .

reports Michael Zolnierczyk, Triangle Tooling Supervisor. Former floor-to-floor time, using mechanical clamping, averaged 57 minutes per piece or over 142 hours per 75 pairs. With Newton Hydraulic System, average floor-to-floor time has been cut to 17 minutes per piece, or 42 hours per 75 pairs, including set-up time. "The above figures," states Mr. Zolnierczyk, "represent a saving of 40 minutes per piece part, which is a production gain of 335%." Photo above shows Newton Hydraulic Tooling System installation machining fragile guide rails for conveyor system of meat packaging machine.

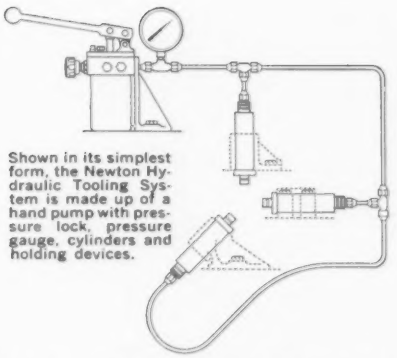
(The Triangle Package Machinery Company, Chicago, Illinois, manufactures filling, packaging and wrapping machines of particular importance to the food industry.)



R & H MACHINE SERVICE CLAMPS ODD-SHAPED PARTS RAPIDLY . . .

according to Robert Miller, Chief Engineer, who says: "The new Newton Hydraulic Clamping System is readily applied to a drilling jig for an odd-shaped casting, which would be awkward to clamp by other methods. Shown above are views before and after the part is positioned for drilling." Adds Mr. Miller, "Clamping and unclamping are far more rapid than would be possible with manual clamps. Pressure is uniform regardless of small variations in the size of castings or parts. Economy is another advantage. All the units, with the possible exception of some of the piping, can be used over again on other jigs and fixtures."

(R & H Machine Service, Cincinnati, Ohio are special machinery and tool builders.)



Shown in its simplest form, the Newton Hydraulic Tooling System is made up of a hand pump with pressure lock, pressure gauge, cylinders and holding devices.

Newton Hydraulic Clamping can speed up your production, too . . . . .

Newton System permits rapid operation of clamps in jigs and fixtures in a matter of seconds compared with the minutes lost by mechanical clamping. System consists of actuating pump feeding a number of clamping cylinders with hydraulic fluid under pressure. Extremely versatile, any number of cylinders usable up to pump's capacity. Various clamping positions facilitated. Pre-determined line pressures up to 2500 psi, are rigidly controlled. System provides easy, safe operation in confined work areas. Entirely self-contained unit. Screw or lever pumps, equipped with pressure locks, available in 2 sizes. Cylinders in varied size ranges. Hydropneumatic intensifiers also available for utmost clamping speed.

HYDRAULIC SYSTEM ASSURES:

- **Maximum reduction in clamping time**
- **Multiplicity of clamping positions**
- **Fast clamping of odd-shaped parts**
- **Controlled clamping pressures**
- **Decidedly safe, economical operation**
- **Movable self-contained units — independent of outside power**
- **Wide range of pumps, cylinders, and mounting devices**

A Newton engineer will be pleased to show you the efficiency and economy found in hydraulic clamping. Simply fill out and mail the coupon below.

NEWTON
HYDRAULIC TOOLING CO., INC.
AUBURN, MASSACHUSETTS

NEWTON HYDRAULIC TOOLING CO., INC., AUBURN, MASS.

I would like more information about Newton Systems.

☐ Send literature ☐ Send representative

NAME & TITLE:_____

COMPANY:_____

ADDRESS:_____

CITY:_____ STATE:_____

why you get ABC drill jig bushings faster

My name is Lou Martz. It's possible some of you may know me by name—for many of our ABC Bushing customers phone in their orders. That's my job—handling your telephone and mail orders. ● There are several of us at the Accurate order desk. We see to it that your orders are filled fast—and accurately. In many cases, orders are shipped the same day we get them. ● We like our jobs and we like being able to give you better bushings—faster. ● Give us your order, today, and let us prove to you that ABC Drill Jig Bushing service is the best—you'll become an ABC enthusiast, too. ● Write for Catalog B-58.

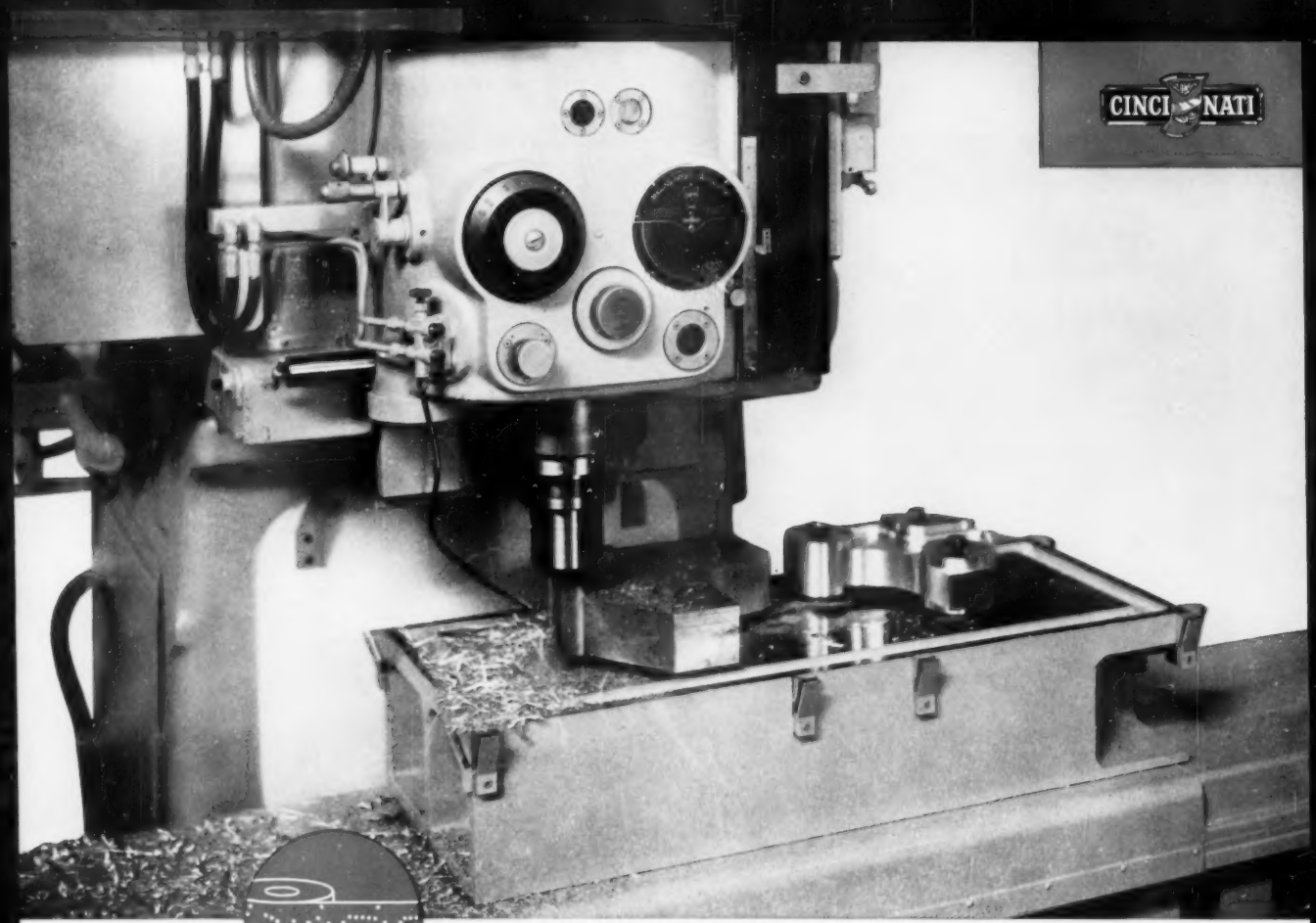
ACCURATE BUSHING COMPANY

443 North Avenue, Garwood, New Jersey

ASA Standard Drill Bushings • Precision Parts • Lift-Swing Drilling Fixtures

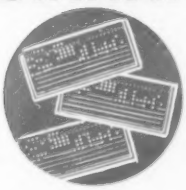
Use Reader Service Card, CIRCLE 47

Use Reader Service Card, CIRCLE 48



Just a simple adjustment of ACRAMATIC's Cutter Compensation Control, and this CINCINNATI 16" x 30" Hydro-Tel changes from roughing to finishing cut. These typical workpieces also demonstrate ACRAMATIC's ability to mill "mirror image" parts without re-programming.

CINCINNATI Acramatic Numerical Control

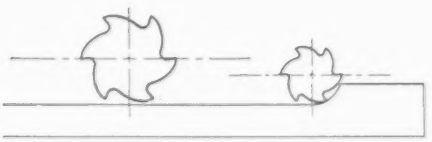


Lets you change cutter diameter or depth of cut . . . without re-programming

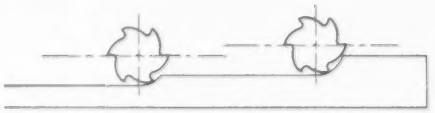
ACRAMATIC is a highly accurate numerical control system, based upon the use of precision toroidal transformers. Its relative simplicity permits a number of unique operating advantages. The Cutter Compensating Control is an outstanding example.

A contouring operation usually permits no variance from the programmed cutter size. But with CINCINNATI ACRAMATIC'S Cutter Compensation, cutting tools varying as much as 1" diam. may be employed by means of one simple dial adjustment. Machine operators thus can change or resharpen the cutter anywhere in a cut. The same dial adjustment permits both rough and finish cuts without altering the program. ACRAMATIC provides added flexibility by the fact that one program can serve for both left- and right-hand parts (mirror images).

The ACRAMATIC system offers many other cost-saving advantages. We will be glad to send you our new publication No. M-2125, which gives further information. **The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**



Exclusive Cutter Compensation feature eliminates re-programming for cutters of varying OD. Notice how centerline of the replacement cutter changes to compensate for difference in OD.



For rough and finish cuts, Cutter Compensation alters path of cutter by an amount equal to stock removal of finish cut.

MMT·PE

Booth No. 1034

BUILDERS OF FINE MACHINE TOOLS: MILLING • GRINDING • BROACHING • ELECTRICAL DISCHARGE MACHINING • DIE SINKING • CUTTER AND TOOL GRINDING • PRODUCTION LINES • METAL FORMING • • • HARDENING MACHINES

CINCINNATI®

NEW TOOL STEEL SERVICE

simplifies purchasing (and saves money, too)

Buying assorted brands of tool steel creates costly paperwork for your . . .

purchasing and receiving departments — manufacturing and accounting, too.

With Crucible's new Tool Steel Service you cut these costs substantially

because you buy fewer grades of tool steels to do more jobs . . .

eliminate piles of paperwork throughout your plant . . .

carry fewer pounds in stock (reduce chances of inventory "mix-ups"), and . . .

pay a lower price per pound (by eliminating costs for small quantity "extras").

MORAL

You benefit with Crucible's new Tool Steel Service. For the full story, call in a Crucible Service Engineer.

CRUCIBLE STEEL COMPANY OF AMERICA

Branch Offices and Warehouses: Atlanta • Baltimore • Boston • Buffalo • Caldwell, N. J. • Charlotte • Chicago • Cincinnati • Cleveland • Columbus • Dallas • Dayton Denver • Detroit • Erie, Pa. • Grand Rapids • Houston • Indianapolis • Los Angeles • Miami • Milwaukee • Minneapolis • New Haven • New York • Philadelphia Pittsburgh • Portland, Ore. • Providence • Rockford • Salt Lake City • San Francisco • Seattle • Springfield, Mass. • St. Louis • E. Syracuse • Tampa • Toledo • Tulsa
CRUCIBLE STEEL OF CANADA, LTD., SOREL, QUEBEC, CANADA

they turn in top performance to turn out top results

SIMONDS CENTERLESS GRINDING WHEELS

top rated for fast, free-cutting . . .
high production . . . long wheel life

"Ground 70,000 pieces compared to 45,000." "Held corners and shape better than wheels previously used." "Entirely satisfactory. Gave excellent finish." These comments from users* are some reasons why Simonds Centerless Wheels are rated superior for job-to-job dependability . . . and good reasons why *your* way to accurate, lower cost centerless grinding may lie in switching to Simonds Wheels. Write for bulletin ESA 55.

*Names on request.

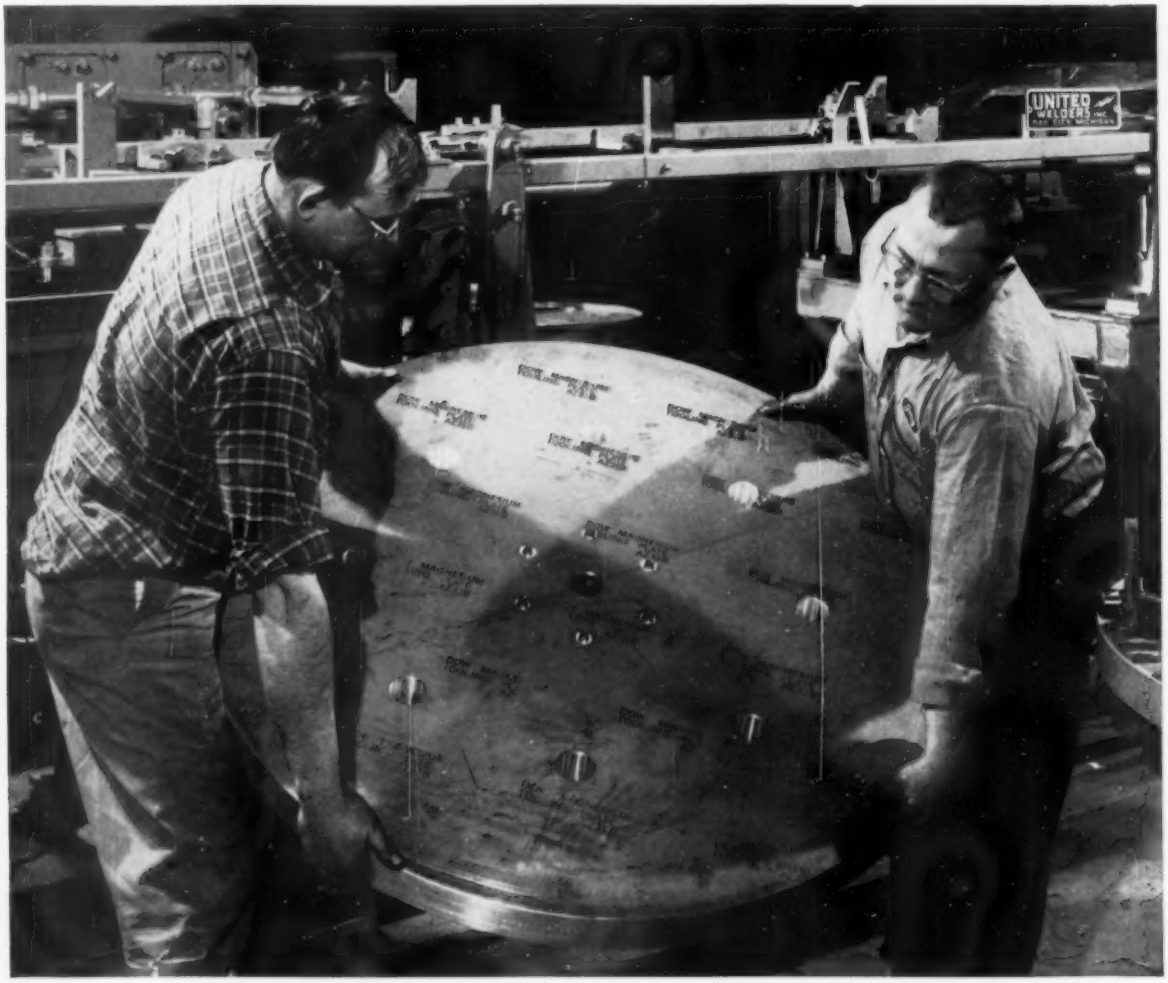
SIMONDS ABRASIVE CO.
Tacony & Fraley Sts.
PHILADELPHIA 37, PENNA.
Division of Simonds Saw and Steel Co.
COUNT ON / YOUR SIMONDS DISTRIBUTOR
FAST SERVICE • LOCAL STOCKS

REGULATING WHEEL
Rubber bonded feed wheels exceptionally long wearing and have good traction . . . perfect mate for the Simonds Grinding Wheel.

GRINDING WHEEL
Job-proved Grain and Grade Specifications for all materials. Karvit bushed non-metallic center hole for better mounting and balance.

WEST COAST PLANT: EL MONTE, CALIF.—BRANCHES: CHICAGO • DETROIT • LOS ANGELES • PHILADELPHIA • PORTLAND, ORE. • SAN FRANCISCO SHREVEPORT — IN CANADA: GRINDING WHEELS DIVISION, SIMONDS CANADA SAW CO., LTD., BROCKVILLE, ONTARIO • ABRASIVE PLANT, ARVIDA, QUEBEC

DOW | NOW IN MAGNESIUM AND ALUMINUM

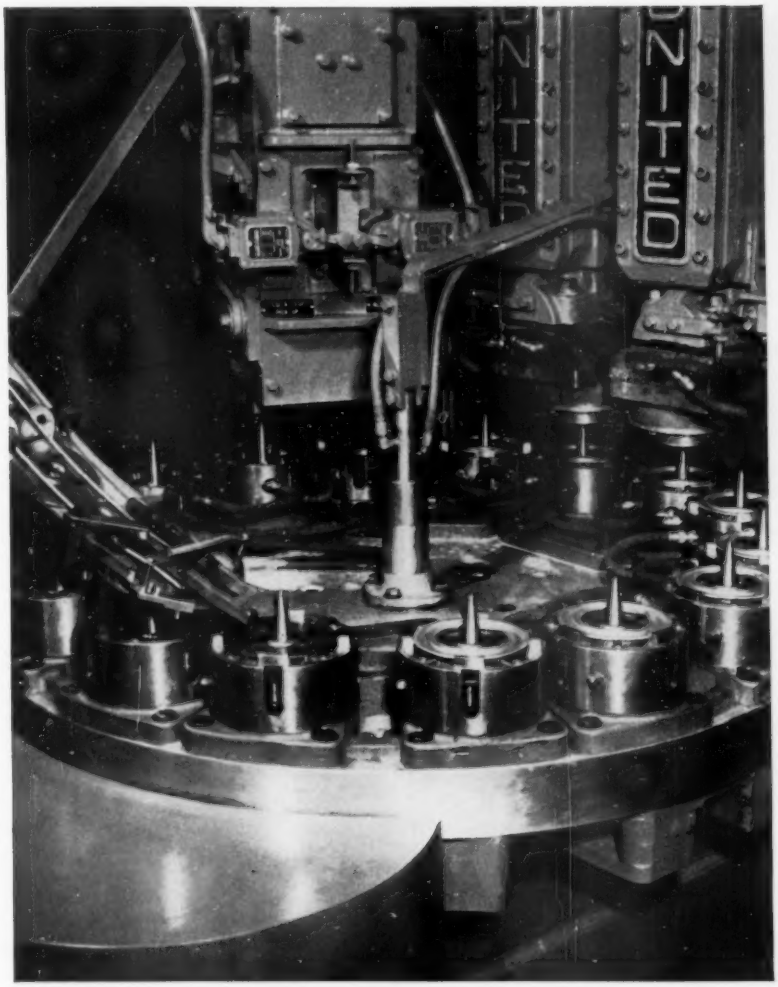


10¢ PHONE CALL CUT MACHINING TIME 50% ON 3-FT. INDEX TABLE!

Ordered-by-phone magnesium tooling plate disc replaced cast steel index table for machinery manufacturer . . . "as purchased" flatness cut previous machining time on this part in half . . . saved 50% on machining costs.

United Welders Inc., of Bay City, Michigan, recently replaced steel with magnesium tooling plate in making the precision index table, or dial, for their automatic 8 Station Dual Dial Welder. This machine is used in welding the bottom gasket retainer for an oil filter assembly in 1960 automobiles.

The dials previously were made of cast steel which required costly, time-consuming surface and edge machining to finish. The 2½ inch by 36 inch dials of magnesium tooling plate are now purchased rough-cut to size from the local Dow magnesium distributor, and are finished by simply edge truing and drilling. Because the as-purchased flatness completely eliminates need for surface machining, United's machining costs on this part have been cut by more than half. Production has been speeded, too, because magnesium's light weight makes the dials easy to handle during manufacture. Two men can easily lift and handle the light disc. Cranes or lift trucks aren't needed as they were with the previous steel dials.



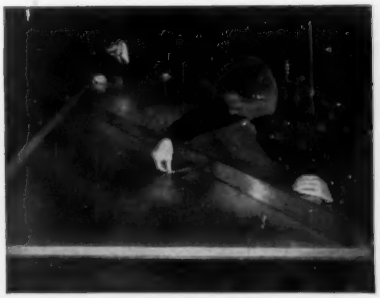
LIGHTNESS CUTS POWER NEEDS 75%

In the United welder above, the dial starts and stops 500 times per hour during welding operations. This lightweight magnesium dial requires only a quarter of the power needed to operate the previous steel dial. It permits a drastic reduction in the cost and size of motor, speed reducer and other necessary driving elements.

RIGIDITY MEANS ACCURATE POSITIONING

United Welders employs a Geneva Stop Movement to position parts accurately under dual automatic spot welding heads. Magnesium's rigidity helps the dial retain close tolerances necessary for continued accuracy.

Magnesium tooling plate has other advantages, too. It costs less to buy than other lightweight tooling materials and can easily be welded. It can often be obtained ready-cut-to-shape from distributors, saving additional time in your shop.



Because magnesium tooling plate is uniformly flat, it can be used for almost all tooling jobs without surface machining. It's rolled and thermal flattened to close flatness tolerances . . . high dimensional stability keeps it flat in use.

MAGNESIUM TOOLING PLATE IS AVAILABLE FROM STOCK AT:

E. F. Bailey Company
Seattle, Washington

Clendenin Bros., Inc.
Baltimore, Maryland

Copper and Brass Sales, Inc.
Cleveland, Ohio; Detroit 12, Michigan

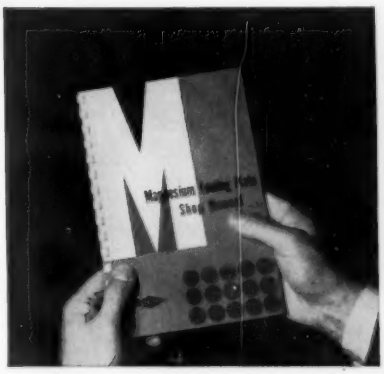
Fullerton Steel and Wire Company
Chicago 35, Illinois

Hubbell Metals Inc.
St. Louis 3, Mo.; Kansas City, Mo.; Marietta, Ga.

A. R. Purdy Co., Inc.
Lyndhurst, New Jersey

Reliance Magnesium Company
Los Angeles 58, California

Joseph T. Ryerson & Son, Inc.
Dallas, Texas



There's a wealth of information in Dow's new magnesium tooling plate manual. This handy 56-page book is filled with facts about shop working characteristics, machining, etc. For a copy, contact your Dow branch office or write to THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Dept. 1033FJ6.

THE DOW METAL PRODUCTS COMPANY, Midland, Michigan
DIVISION OF THE DOW CHEMICAL COMPANY

Precision and Versatility for Short Runs

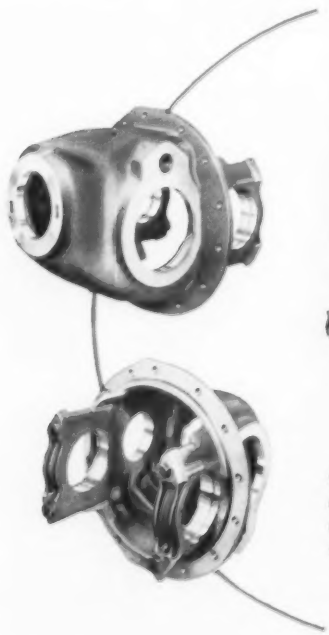
New Cross Precision Boring Machine for Differential Carriers

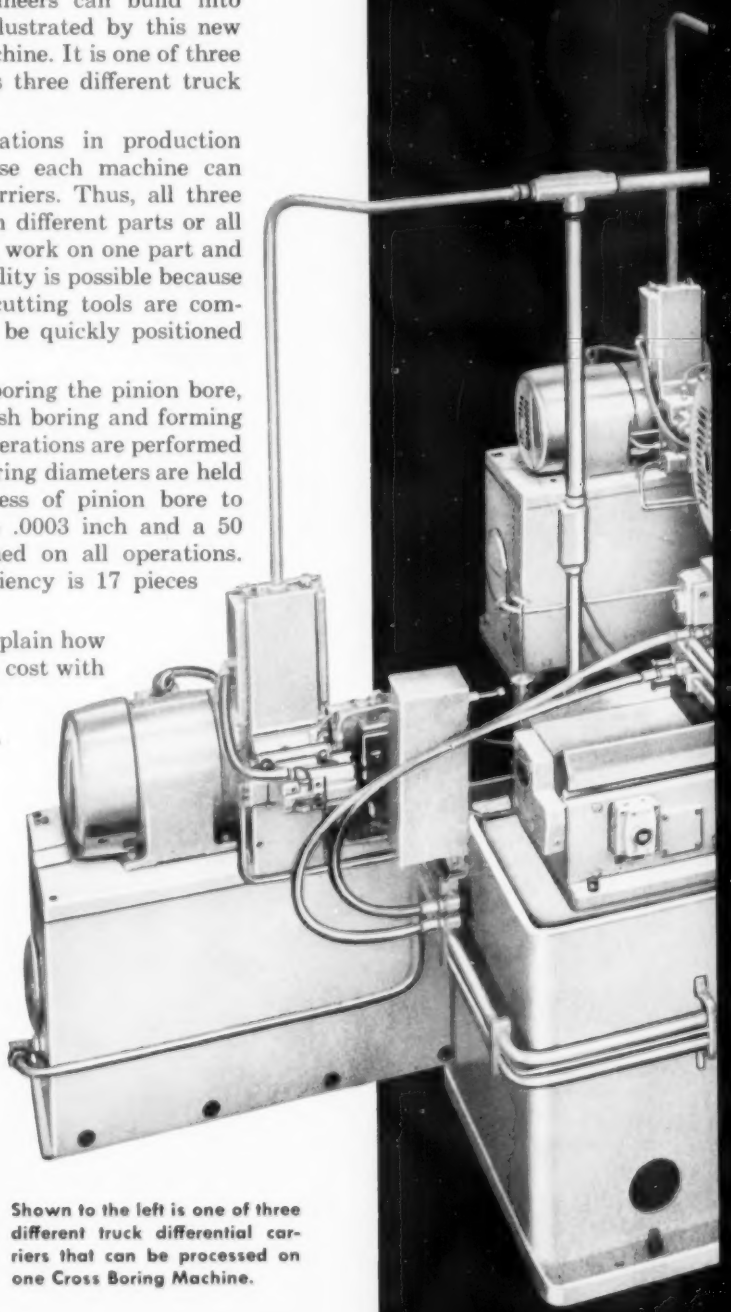
The versatility that Cross engineers can build into automation equipment is well illustrated by this new Three-Way Precision Boring Machine. It is one of three similar units designed to process three different truck differential carriers.

Unusual flexibility for variations in production requirements is provided because each machine can process any one of the three carriers. Thus, all three pieces of equipment can work on different parts or all can work on one part or two can work on one part and the third on another. This versatility is possible because the fixtures, boring heads and cutting tools are completely interchangeable and can be quickly positioned for each carrier.

Processing consists of finish boring the pinion bore, finish facing the pinion boss, finish boring and forming grooves in the cross bores. The operations are performed to a high degree of precision. Bearing diameters are held to less than .001 inch, squareness of pinion bore to pinion mounting face is held to .0003 inch and a 50 micro inch rms finish is obtained on all operations. Rated production at 100% efficiency is 17 pieces per hour.

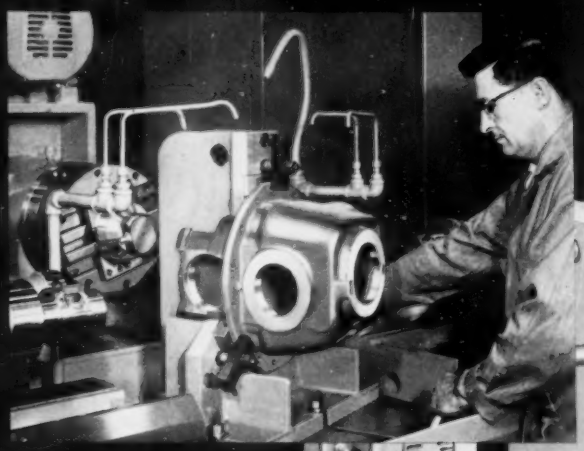
Let a Cross Sales Engineer explain how you can do precision work at low cost with versatile automation equipment.





Shown to the left is one of three different truck differential carriers that can be processed on one Cross Boring Machine.

Another Automation First by Cross



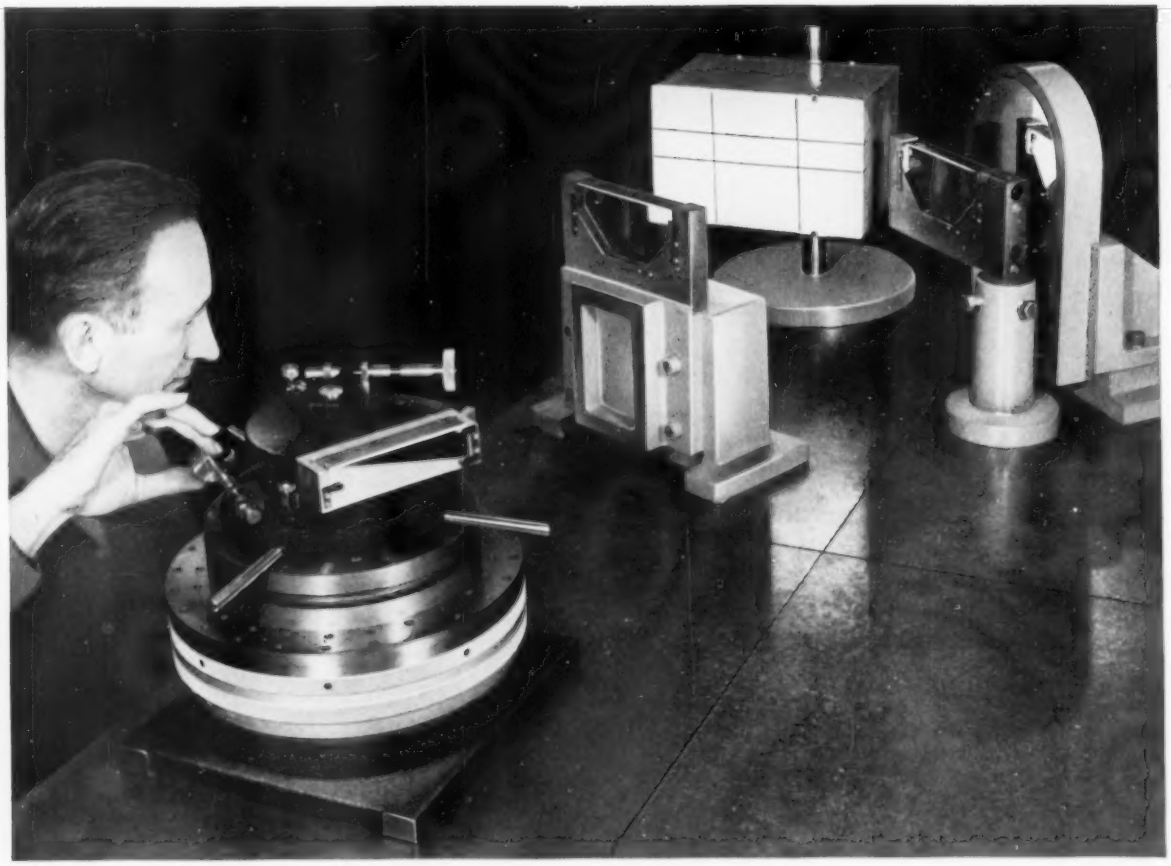
The work-holding fixture is mounted on a precision index table which rotates 180 degrees for easy loading and unloading.

Established 1898

THE **CROSS** CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN



This man is working

If you have never visited Michigan Tool's research and development laboratory, you really should. The birthplace of so many ideas—processes, equipment, tools and materials—industry today takes for granted, its activities have grown enormously with the broadening of Michigan Tool's services to industry.

The lab has two purposes.

The first, to find the answers to your immediate questions—in every phase of gear

Michigan Tool Company

Use Reader Service Card, CIRCLE 52

Use Reader Service Card, CIRCLE 53

MTC Research Engineer using an angular interferometer to check an indexing table. Accuracies to a millionth of an inch at 1 inch radius are possible with this equipment. Interferometer room temperature is controlled to ¼° F.

for YOU

production, in automation, in generating of forms in hard materials, in producing prototype gearing, etc.

Its second job is to find the solution to some of the problems you will face tomorrow —to keep up the pioneering pace of engineering leadership that produced such innovations as gear shaving, Roto-Flo cold forming, Shear-Speed gear cutting, double-enveloping gearing, "Velvet-drop" feeders and other ideas for automation systems, Sine-Line optical checking, and many others.

7171 E. McNICHOLS ROAD • DETROIT • TW 1-3111

Plants in: Detroit, Traverse City and Manistee, Mich. and Windsor, Ontario.

Gear Production: The most complete line of equipment for gear production offered by any manufacturer.

Hobbers and Shapers for Job Lots
High Production Hobbers
Shear-Speed Gear Shapers
Roto-Flo Cold Forming
Shavers for gears of ½" to 200"
Internal and External Form Grinders
Sine-Line Gear and Tool Checkers
Gear Chamfering Equipment
Abrasive Gear Finishers
Mitco Quality Gear Cutting Tools

Automation Equipment (Gear-O-Mation Division): Engineering and manufacture of simple and practical equipment for automating a plant, a line, or a machine. Pre-engineered units for orienting, storage, loading, unloading, assembling, conveying, escapements, positioning, elevating, deeding.

Form Grinding (Gear Grinding Machines Division): "Detroit" fully automatic form grinders for both external and internal contours—involute, cycloidal, spherical, straight sided.

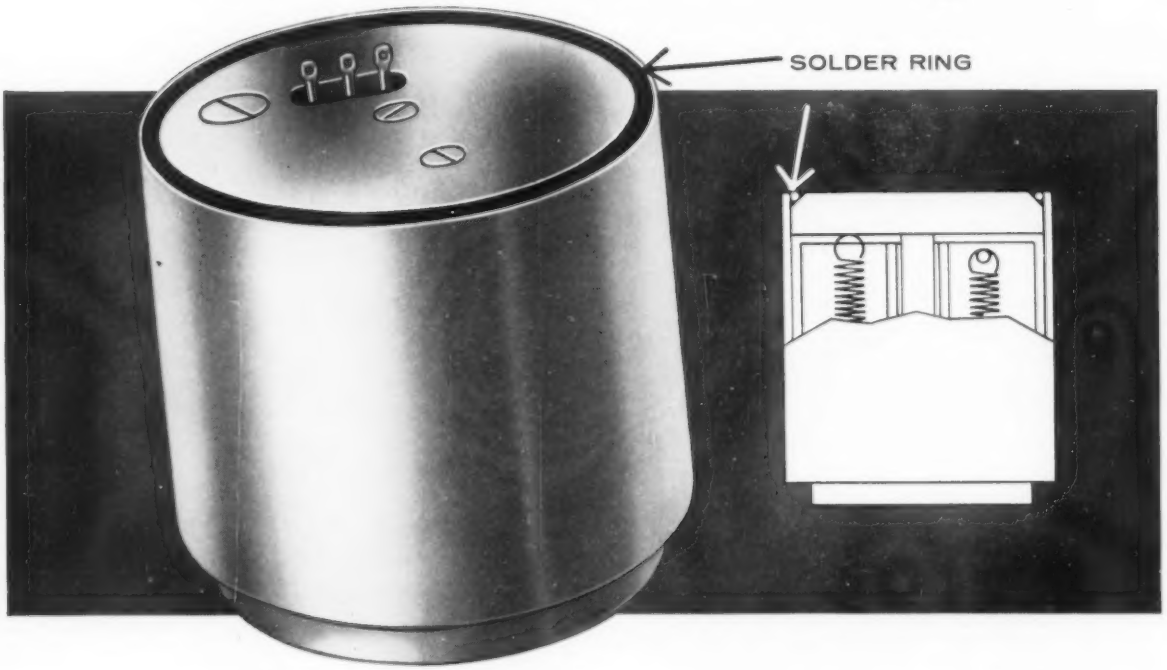
Prototype Gearing (Enterprise Division): Spur, helical, bevel gears and splines for prototypes and in developmental quantities. Also contour form grinding, internal and external.

OTHER MICHIGAN TOOL DIVISIONS INCLUDE:

Cone-Drive Gears Division (double-enveloping worm gears, speed reducers, gear motors); Michigan-Lorenz Division (hobbers and shapers); Shear-Speed Chemical Products Division (coolants and cutting oils); Colonial Tool Co. of Canada Ltd. (cutting tools of all types).

Precision soldering 7 Times Faster...

with TOCCO* *Induction Heating*



When G. M. Giannini and Co., Inc., Pasadena, California, switched from old-fashioned methods to TOCCO Induction Heating they increased production of these high-precision accelerometers from 4 to 30 per hour—with a commensurate *decrease* in production costs.

Here's what a Giannini official has to say about the TOCCO installation: "Prior to using TOCCO for this purpose, we had tried soldering irons, normal torches, resistance sealing, and even threaded screw fittings, with uniformly poor results. Essentially, the TOCCO unit has permitted us to build, in production quantities, oil-filled hermetically sealed units that could not be produced in any other way."

Whether your production bottleneck involves soldering, brazing, heat treating or heating for forming it pays you to investigate TOCCO as an economical way to do it better, faster and at lower cost.

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today— NEW FREE Bulletin

The Ohio Crankshaft Co. • Dept. G-6, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Brazing and Soldering".

Name _____

Position _____

Company _____

Address _____

City _____ **Zone** _____ **State** _____

Our Objective

You often hear the expression "the customer is boss." You—the members of ASTME—are the customers of the Society. You are "the boss."

Your National Directors, whom you elect, choose your Officers and the Executive Secretary to head up national activities. They know what you want because they have talked personally to many of you.

As the customer who is always right, you have told us that you want to improve your technical competence. You want to contribute more to your chosen field of manufacturing. You want to increase your income, to better provide the good things in life for your family. You want to associate and exchange experiences with others who have similar problems and similar aspirations. In short, you want to get ahead—and, rightfully, you expect the Society to help you.

Our constitution states the Society's purpose: "the advancement of scientific knowledge in the field of tool engineering." In recognition of our Society's expanded name and ever broadening role in industry, I often rephrase ASTME's purpose as "the advancement of knowledge in the field of manufacturing."

What are some of the ways the Society goes about accomplishing this objective? Through chapter technical meetings, expositions, THE TOOL ENGINEER, seminars and conferences, handbooks and textbooks, research programs, and personal exchange of experiences. Through such means the Society helps you add to your treasure chest of manufacturing know-how.

But knowledge becomes useful only when it is used. Your superior and your company will appreciate the knowledge you have acquired only when you put it to work. That part is up to you.

The Society is dedicated to serving you "the boss."

Dale Long

PRESIDENT
American Society of Tool and Manufacturing Engineers

Quick guide to toolroom requirements

DRILL ROD

Carbon Steel Drill Rod—A high-grade drill rod with smooth finish and extreme size accuracy.

Ry-Alloy® Drill Rod—Non-deforming . . . excellent finish, accurately sized, free from decarburization.

Ry-Alloy Ground Flat Stock—Accurately ground on all four sides. Ends and sides are square, parallel, and accurate to dimension. Free of surface decarburization . . . spheroidize-annealed for best machinability.

TOOL STEELS

Ry-Alloy Tool Steel—An oil-hardening steel. Combines high hardness and deep hardness penetration with minimum distortion, freedom from cracking. Good machinability.

V.D.® Tool Steel—An all-purpose, water-hardening carbon vanadium steel. Easy to machine . . . hard and tough after heat treatment. Hardening characteristics permit wide variation in treatment with uniformly good results.

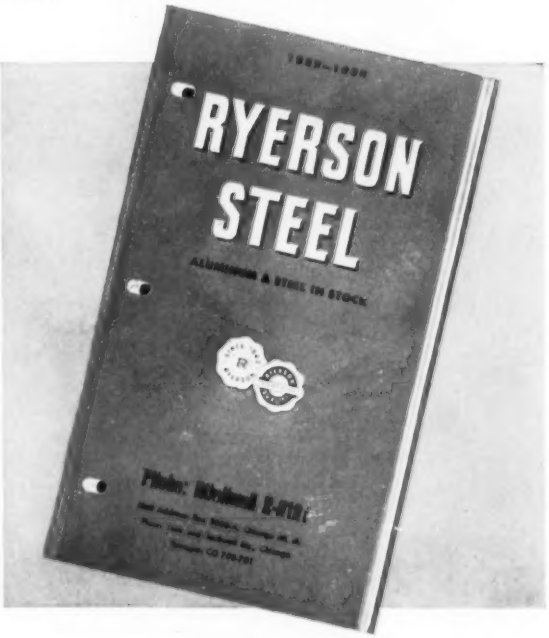
V.D. Chisel Steel—A specially developed, water-hardening carbon molybdenum tool steel ideal for hand and pneumatic chisels.

Tool Steel Sheets—Rolled from high-grade tool steel of about 1.00% carbon. Smooth, blue finish protected by oil. Can be hardened in oil or water; quenching medium depends on hardness desired. 27 gauge up to 3/16″ thick.

AISI-E 6150—For impact applications. Provides relatively high surface hardness while retaining strength and toughness throughout the cross section.

Carbon Steel Plate—All sizes and thicknesses.

E-Z-Cut® Plate—Remarkable free-machining qualities make this plate ideal for die bases, jigs, rubber molds, etc. Up to 30% savings in machining time compared to ordinary steel—with approximately 50% increase in tool life.



ALLOY STEEL PLATE

4140 Plate—An oil-hardening, annealed plate of firebox quality. Specially developed for maximum strength and uniform hardenability throughout the cross section. Thicknesses from 1/4″ through 5″.

E 8615 and 8620 Plate—These oil-hardening, case-hardening alloys are ideal for flats, rings, discs and irregular shapes. Accurately flame-cut to your order.

Cold Finished Bars—A wide range of analyses. Rounds to 10″; squares to 4″; flats to 12″ x 2″.

Stripper Plate—Both surfaces ground and polished to a thickness tolerance of plus or minus .003″. Edges planed instead of sheared or rolled, insuring parallel sides free from strains. Warping and distortion after machining practically eliminated.

Aluminum Tooling Plate—Reynolds Type 33 wrought plate and Pioneer Type 921-T-DC cast plate.

Whatever your requirements, contact your Ryerson representative for widest selection, highest quality, fastest shipment, complete satisfaction.

METALOGICS

STEEL • ALUMINUM • PLASTICS • METALWORKING MACHINERY

RYERSON STEEL®

Joseph T. Ryerson & Son, Inc., Member of the INLAND Steel Family

PLANT SERVICE CENTERS: BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DETROIT • HOUSTON • INDIANAPOLIS
LOS ANGELES • MILWAUKEE • NEW YORK • PHILADELPHIA • PITTSBURGH • ST. LOUIS • SAN FRANCISCO • SEATTLE • SPOKANE • WALLINGFORD

tooling

for the handicapped

...a challenge to engineers

By **John W. Greve**, Editor

Productivity of the handicapped can be greatly increased by special tooling. When tool and manufacturing engineers apply their special knowledge and training to this problem spectacular results are often achieved.

No reward is more satisfying than the knowledge of having performed a service for one's fellow man. This is especially true in industry when a physically handicapped worker is made more productive through tooling engineered to meet his needs. No one is without limitations of some kind. These may involve experience, ability, or dexterity instead of physical handicaps. No matter what the limitation, it deserves attention by our best engineering talent.

Recently, workers with temporary or permanent physical disabilities have received much deserved attention. This attention, however, has been concentrated on isolated and outstanding cases of achievement. Increasing the productivity of the handicapped has not been thought of nor treated as an industrial problem. Much lip service has been given to the problem, but little else is being done.

In many cases the basic requirements for adequate tooling seem simple. Many studies have been made for the physically perfect worker to improve the convenience of machine controls. These studies have involved the natural motions of the human body, direction of motion of an operation with respect to that of its control, association of a manual control with machine operation to minimize errors, and natural position of instruments and levers to avoid confusion. Such exact and precise engineering data are valuable and have been responsible for much progress industrially. The same type of study and analysis can be invaluable in providing aids for the handicapped.

Why has not more been accomplished and why has not more work been done on a broader base? When the rewards are so great, the answer must be due to lack of understanding of the problems involved. These problems are linked to the unpredictable nature of a human being. The fear of failure takes on added significance. It is far easier to work with inanimate machines. Their functions and performance are easily predicted and charted. This

Fig. 1. Making electrical assemblies requires highly developed skills. This operator substitutes touch and sound for his lost sense of sight. Carefully arranged bins and locating notches on fixtures aid him in performing work comparable to that produced by other workers without any physical handicaps.

is not always true for the human being, especially from day to day.

This fear of failure may be a real psychological block. The engineer must deal with the human being as a machine. Trends in engineering, however, have been in another direction. The engineer has done everything economically justified to remove the human equation from the machine. Where applicable, this trend has been admirable and effective. In addition to removing drudgery from work, it has increased productivity, reduced accidents, improved the product, eliminated spoilage and brought the cost of many articles within the reach of mass markets.

Vast areas of industrial work, however, still require repetitive operations as well as manually directed and controlled machines that need the decision-making ability of the human being as an operator. In this area much has been done but there remains much more to do. Pushbutton stations long ago replaced awkward and clumsy levers and mechanical linkages. Besides removing drudgery from the work, intelligent mechanical and electrical aids have increased the productivity of the worker and elminated many hazards to both the operator and workpiece. This same basic thinking should be extended to tooling for the handicapped.

Tooling for humans requires the specialized abilities of tool and manufacturing engineers. This form of tooling may be divided conveniently into four important areas. Each requires intensive research and development similar to that given to conventional and normal tooling. In addition, each also requires the cooperation of the medical profession. They may be listed broadly as:

1. *Physical-aid tooling:* Specially designed jigs, fixtures, controls and operating devices to facilitate work by the physically handicapped.
2. *Therapeutic tooling:* Controls, operating levers and devices designed to aid the recovery of an injured worker through exercise.
3. *Prosthetic tooling:* Design and development of adequate prostheses to approach the operation and efficiency of the body parts they replace.
4. *Surgical tooling:* Scientifically developed and engineered instruments and equipment to keep pace with operative techniques of surgeons.

All of these have one thing in common: They apply either directly or indirectly to the human as a machine. Each is highly personal and personalized. Improving these tools is indeed serving mankind in many ways beyond increasing production.

Problems of Rehabilitation

To find outstanding examples of tooling aids, more than one hundred manufacturers and interested organizations were contacted. Many diverse viewpoints were found. To some manufacturers, the thought of helping handicapped workers with special tooling had never occurred. Some informed sources said the handicapped must learn to compete

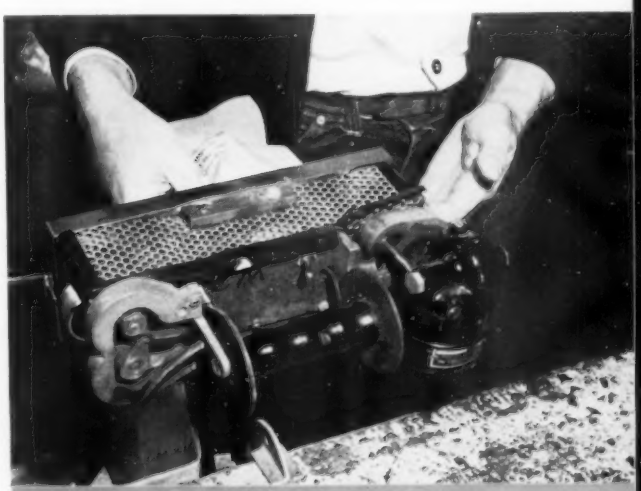


Fig. 2. Guard on heat sealing machine, developed as an aid to handicapped workers, has also proved of assistance to all workers.

with the physically perfect worker, but without special aids. These authorities seemed to ignore the worthwhile achievements that had been made possible for normal workers through the application of logical placement of controls and their simplification. Placement and arrangement of tooling for handicapped is to a great extent a mere extension of the problem.

Only a few companies reported unsatisfactory experiences with handicapped workers. Most reported workmanship and dependability equal to or superior to that of the normal worker, even though little or no special tooling was involved.

One authority, considered a leader in the field of rehabilitation commented: "As a matter of fact, present-day thinking and practice in the rehabilitation field are opposed to the redesign of tools, particularly machines, controls and the like, in order to accommodate the job placement of handicapped persons." This same authority also stated: "However, we do not believe that redesigning of jobs, tools and controls to fit the handicapped worker is the long-range answer, but rather the redirection or retraining of the individual and his effective placement in a job under competitive and accepted conditions of employment."

This viewpoint is supported by the belief that a worker is more independent if he competes on an equal job basis. Then industry may be more inclined to hire him than if special considerations were involved. This may be true when rehabilitation centers train the handicapped for return to industry. It seems, however, like a double penalty—the handicap and the lack of tools. Tools, in the ideal sense, should be made to aid the worker and minimize his limitations. What is an aid to a normal worker may be useless to a physically handicapped worker.

In this country, using the handicapped productively is not universal. Industry has not been aware of the potential productivity of physically handicapped workers. Instead, handicapped workers have been regarded as a responsibility of society as a whole, rather than as a responsibility of industry.

In Europe, employing the physically handicapped is a responsibility of industry. Plant management in Germany, for instance, must provide for ten percent of personnel having physical disabilities of some kind. This is mandatory by law. Probably the devastating effects of wars and the normal desire of the maimed to be self-sufficient have been responsible. This is a realistic approach from which we can profit and for which data are available.

Physical-Aid Tooling

Examples of special tooling, however, show that worthwhile results can be obtained with a specialized approach to the worker's requirements for a specific job. For instance, at Paraplegics Mfg. Co., Franklin Park, Ill., specially designed tooling has provided productive employment at full industry standard rates of pay for workers who have suffered the loss of sight, hearing, legs or arms, as well as paraplegics and others with limited physical capabilities. With special tooling, approximately one hundred handicapped men and women compete in the open market for fabrication and assembly business.

Blind workers usually require a minimum of special facilities and are useful for many jobs. They learn assembly operations quickly when parts are arranged conveniently for memorizing. Because of the loss of sight their other senses are sharpened immeasurably. Shown in *Fig.* 1 is a blind worker at the Hughes Aircraft Co. An electronics assembler, he has his parts arranged in much the same manner as a typewriter keyboard. Items used most frequently are in the center and most accessible position. The location of each part is, of course, memorized.

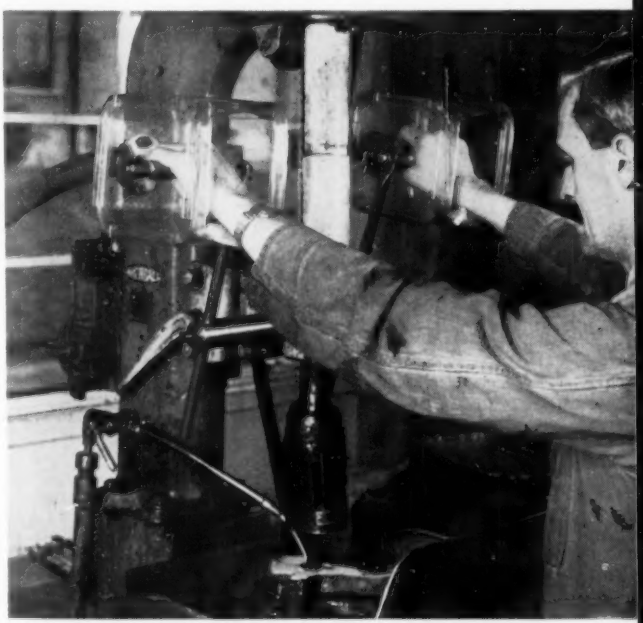


Fig. 3. Physical medicine aids worker with arthritis. Warm air is blown around hands, enabling worker to produce a normal day's work which would be prohibitive otherwise due to pain.

Shown in *Fig.* 2 is a machine for hot sealing plastic bags. This machine is used at Norair, a division of Northrop Corp. and is a modified standard sealer, permitting blind personnel to operate it safely. The sheet-metal guard protects the feed belt and keeps the operator's hands from the heated parts. This aids the blind in feeding plastic bags

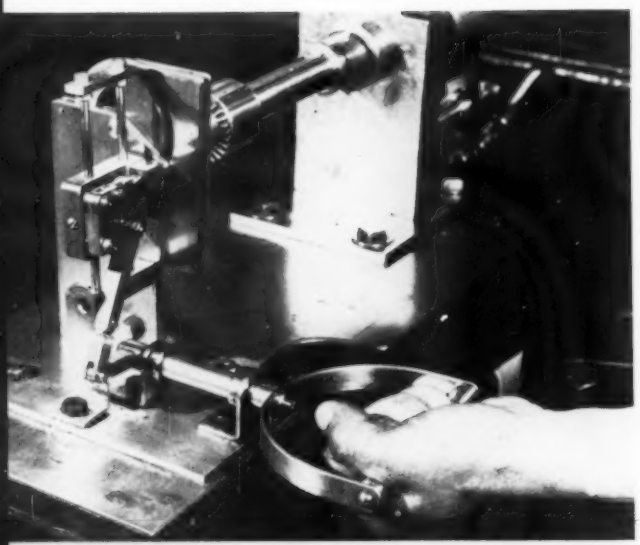


Fig. 4. Indexing mechanism designed to require operator to twist arm. This therapeutic tooling aids in recovering of injured.

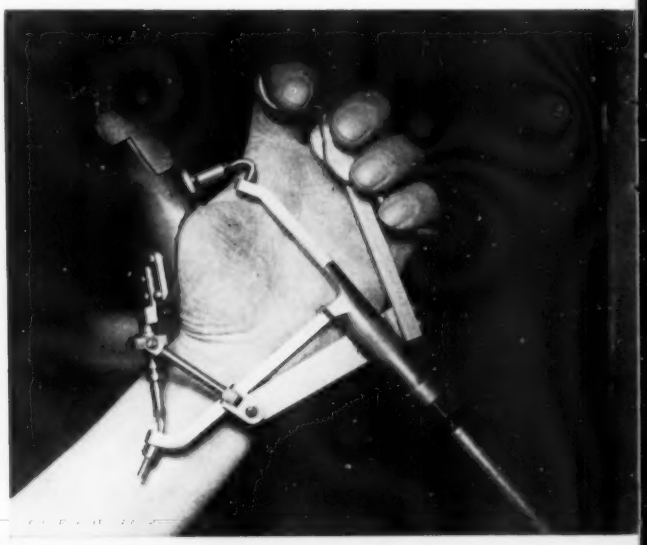


Fig. 5. Therapeutic tooling exercises fingers while they productively operate a drill press.

into the proper channel. Like many other operations at Norair, this modification also improved operation by the nonphysically handicapped.

Therapeutic Tooling

With proper supervision of the medical department, tooling can provide exercise of the proper kind and in the desired amount to aid and even accelerate healing. It is difficult, however, for a tool and manufacturing engineer to design control levers that deliberately have resistance designed into them and that may be arranged in a manner not the most convenient for a normal person. Such, nevertheless, is often required for proper exercise.

Outstanding and original work in exercising injured muscles and joints has met with unusual success at Vauxhall Motors Ltd. in England. Shown in *Fig.* 3 is a method of providing physical therapy through remedial exercise on a drill press. The worker suffers from severe rheumatism of his hands, which are enclosed in plastic boxes into which hot air is fed by fan. Thus the worker is able to keep his joints on the move without pain and at the same time perform useful work.

To develop strength and movement in the forearm, the equipment shown in *Fig.* 4 has been added to a hand tapping unit at Vauxhall. The handle must be rotated in order to bring the next hole into position for tapping. Another example of an exercise device is the grip shown in *Fig.* 5. It is attached to the operating lever of a drilling machine and was designed by Vauxhall to flex the finger joints, thus preventing stiffness. The machine is operated by moving the lever in a downward direction, closing the fingers into a fist around the lever.

Also, in *Fig.* 6 is shown a grip attached to another drill press. This grip is used to obtain extension of the fingers following operative treatment for tendon injuries. Depressing the top plate overcomes the resistance of drilling and brings the bar gently down onto the back of the hand.

A lively splint, designed and manufactured in the retraining shop of Vauxhall, is illustrated in *Fig.* 7. It is used during the assembly of vehicle components, giving assisted extension to fingers and thumb following bone grafting and tendon repair.

The horizontal drilling machine shown in *Fig.* 8 has special controls also designed in the Vauxhall retraining shop. It is used to exercise injured shoulders and backs. It encourages full and powerful movement of the arm and shoulder joints.

Many problems of workers' injuries have been solved with molded plastic splints. Workers with conventional plaster splints cannot work satisfactorily around jobs using cutting fluids. With the molded splints, the difficulties are minimized. If a worker gets his splint wet, he merely reports to the dispensary. There his splint can be removed, washed and replaced without difficulty.

Prostheses

W. C. Gorthy, director of the Institute for the Crippled and Disabled in New York, has dramatically demonstrated some needs of amputees. He has

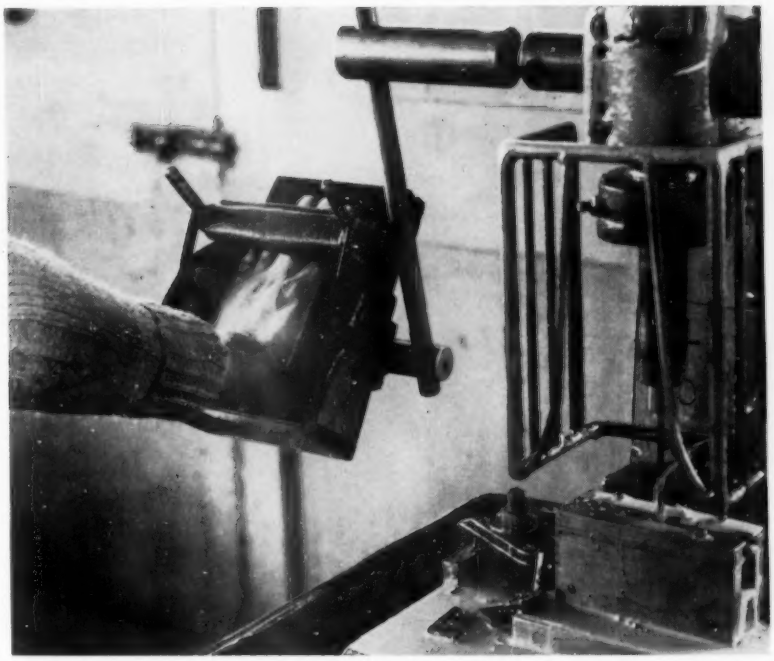


Fig. 6. Operating lever extends fingers following surgery on flexor tendons. A linkage also brings bar down on back of hand to stretch fingers. Wrist is exercised at the same time.

shown requirements ranging from aesthetic desires to the needs for efficient prosthetic devices. He poses the problem of developing a plastic that would tan by exposure to the sun much like real skin. It is not difficult to appreciate the uplift in morale that would result. Also, artificial limbs in use today are highly inefficient. Mr. Gorthy looks forward to powered devices that are not heavy and that, of all things, are controlled by minute voltages of brain waves and sensory nerves to do the things the owner wills without intermediate efforts. This is not beyond the possibility of reality and is the type of project worth the effort and best thinking of medical specialists and engineers.

Surgical Tooling

Surgeons, for want of better methods, must invent their own tools and instruments for specialized techniques and procedures. If a particularly successful tool is developed by one surgeon, it may not find wide use even though it may be ideal for the special procedure. For lack of proper recognition, it may be forgotten through disuse. Surgical and operative techniques have been developed at accelerating rates. It seems like asking too much of the busy surgeon to expect him to go into his laboratory and develop the tools he needs. His time would be better spent on his specialty. Instrument and equipment specialists should supply the tools.

After one looks at some of the highly specialized tools in modern industy and sees them perform flawlessly to the extent of self-correction of errors, he would like to be assured that surgical equipment in use today is equal or better than that in industry. This, however, is not always the case. The thought that less-than-the-best possible instruments may be responsible for the life of someone dear is alarming. If the use of inadequate tooling should result in the sacrifice of a life in spite of the best efforts and technology of the surgeon, the heartache would indeed be great.

Dr. Clarence E. Crook, president of the Cardio-Vascular Research Assn., recently told meetings of the American Society of Tool and Manufacturing Engineers in Detroit and in Ann Arbor: "Techniques have outpaced tools in major surgery. . . . We need your engineering brains to come up with ideas and suggestions as to design and manufacture of certain needed devices." He demonstrated some surgical tools presently in use and pointed out their shortcomings. These included a heat exchanger and bubble trap for use in heart operations, as well as a shunt clamp for use as a bypass during surgery on an artery.

A tool engineer who attended one of these meetings developed a heat exchanger and bubble trap at his home. The apparatus has been used successfully in several operations. Its principles are illustrated in the sectional drawing in *Fig.* 9.

This apparatus, although simple in principle, has many critical specifications. It must be stainless steel or a similar material capable of being sterilized at 350 F. It must also be designed so that

Fig. 7. Lively splint assists in extending fingers and thumb following surgery.

no corners or recesses interfere with cleaning. It must handle blood in sufficient volume and maintain blood temperature, either higher or lower than that of the patient, as required.

Also, because air bubbles may be present, the bubble trap must effectively remove them from the blood. The design shown separates bubbles as the blood flows at low velocity over the rim of the inner cylinder. The bubbles are removed through the petcock at the top and can be measured by the syringe. The air is removed so that minimal compressible gas is present, allowing the pulses in the blood flow to be transmitted at as full value as possible. An alternative mounting for the bubble trap head is shown without the heat exchanger.

The other perplexing problem involving the shunt clamp previously mentioned, has had the attention of many engineers. No satisfactory clamp has as yet been made although an apparently adequate design has been developed. Features of a clamp are sketched in *Fig.* 10. The clamp resembles an old-fashioned tire valve. The sealer and foot plates are saddle-shaped to provide an effective seal with the artery wall and to allow for a large bore in the bypass. Flat plates would not be practical because they would restrict the bore size and limit blood flow.

The unsolved problems involve making a double row of serrations on the sealer plate with an intermeshing single row on the foot plate. The teeth have a pitch of 0.025 inch with their axes parallel to the axis of the clamp, regardless of position on the plate arc. This avoids shearing or bruising action on the artery during clamping. Also, for the same reason, the sealer plate must assemble without twist during torquing of the clamp nut.

Many lives will be saved whenever this clamp becomes perfected and can be used without bruising the artery. With properly formed serrations the artery wall is held firmly with minimum pressure.

All attempts to produce the clamp have failed, even though the project appears relatively simple. When one reviews the history of this project and its failure through unproducibility, it is easy to appreciate how Leonardo da Vinci must have felt because his mechanisms were not practicable in his day.

Work on the clamp, however, is progressing because of the urgent need for it. At present, plans are being developed to machine this clamp with the aid of numerical control. If successful, this will be another instance illustrating how engineers can help develop surgical tooling. It is cooperative efforts like this from which progress is made. Think how much faster it could be made if trained and talented engineers could devote full time to medical engineering problems instead of spare time. The resulting designs would be worthwhile.

Economics of Employment

According to information from the Institute for the Crippled and Disabled in New York, rehabilitation programs can pay for themselves financially as a result of increased productivity. This is in addition to the tremendous psychological gain achieved through proper treatment and return of an individual to gainful work.

In New York State alone 4455 disabled persons

Fig. 8. Operating levers are positioned and counterbalanced to increasingly exercise arms and shoulders.

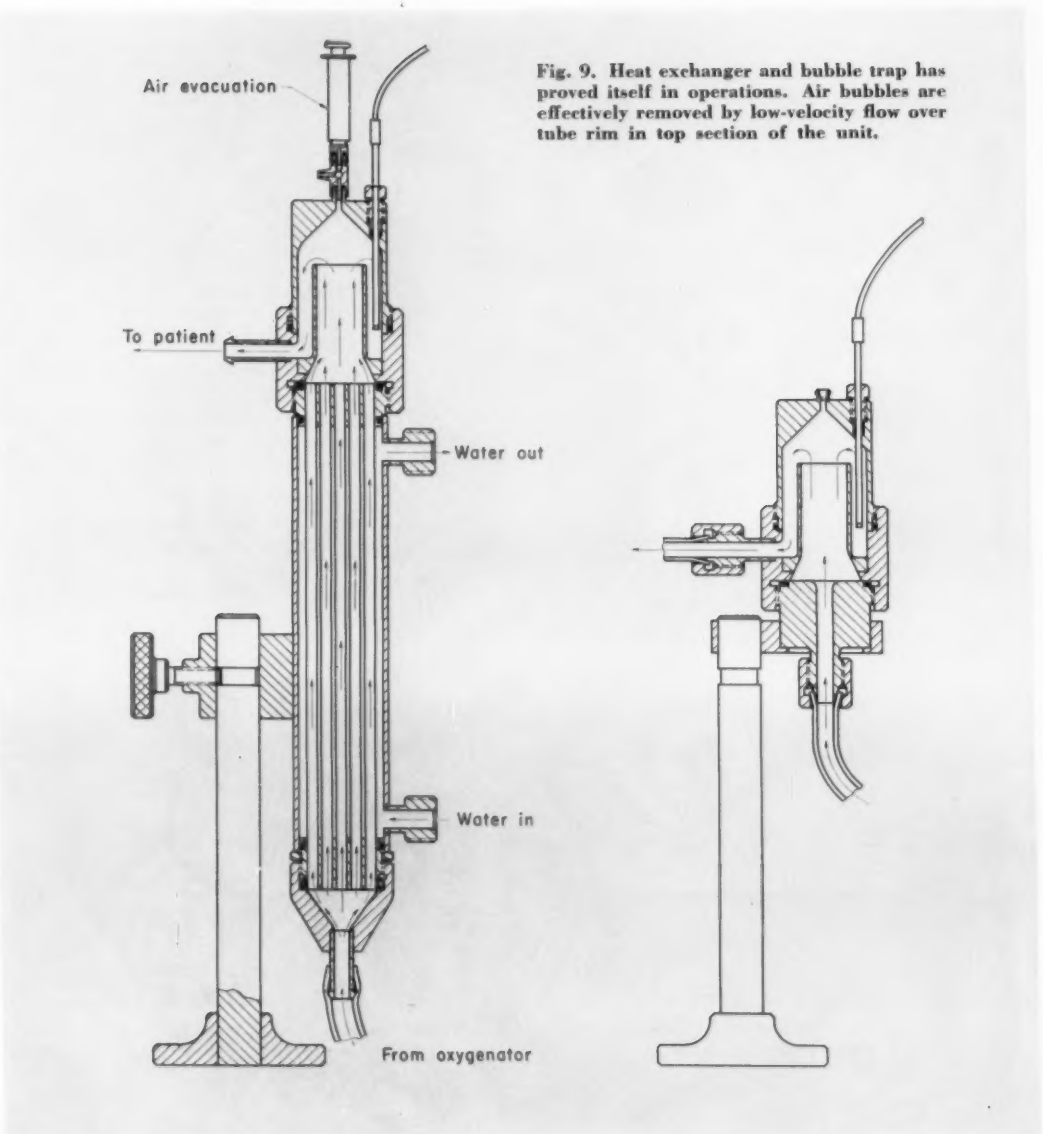


Fig. 9. Heat exchanger and bubble trap has proved itself in operations. Air bubbles are effectively removed by low-velocity flow over tube rim in top section of the unit.

were rehabilitated in 1958. These individuals earned $2¼ million annually before rehabilitation. After rehabilitation, these same workers earned $11 million annually. This is an increase in income of 330 percent at a cost of $1½ million per year. In addition to removing these people from the relief rolls, which amounted to an expenditure of $3¾ million, income tax alone after rehabilitation amounted to more than $1 million annually. The receipts of income tax together with the savings resulting from removing workers from the relief rolls more than paid for the cost of rehabilitation.

With an incentive of this kind it is not difficult to imagine the benefits that are possible through extending rehabilitation programs throughout the nation and throughout industry. With programs expanded to include production tooling and therapeutic tooling the savings and benefits can be tremendous to the individual and the nation.

Whither Tooling?

At present 24 million people in this country have physical handicaps of some kind. Last year work accidents alone accounted for 2 million injuries of varying degree. What proportion resulted from faulty equipment or inadequate tooling is not known. It is the tool engineer's responsibility, however, to furnish tools with which the worker cannot

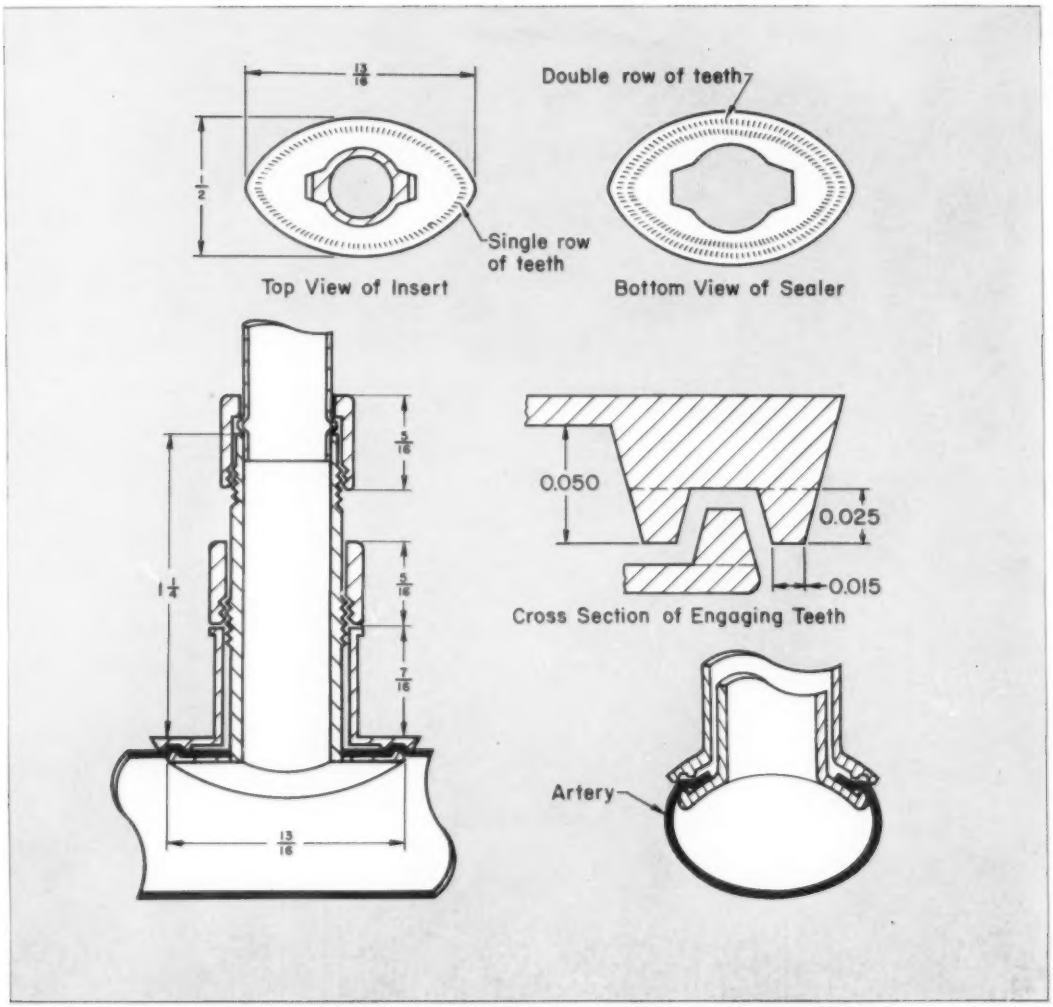


Fig. 10. Suggested design for shunt clamp. If such a clamp were perfected, surgery for repairing arteries would become practicable nearer the heart.

be injured. This is a big order when the accident-prone nature of some workers is considered. Yet the tool engineer must protect that individual against himself.

It is well known that a worker will avoid wearing a mask if it interferes with his comfort even though he may know it is essential to his health. This has been true since the start of the industrial era. It is also well known that a worker may attempt to lock out a safety device if it reduces the effort of his work or permits him to loaf between periods of increased productivity.

We have a battle of wits between the tool engineer and worker. The tool engineer must win the war unconditionally. The search for better safety devices for large presses led to the development of automation. Adequate ventilation has obviated the mask. Condenser fences and light-ray guards have proved foolproof and have eliminated safety buttons. The tool engineer is indeed on the right road. A cardinal rule should always require fail-safe features in a machine no matter how difficult to acquire.

It is the tool and manufacturing engineer who fits the machine to the operator. For best performance he should do his job so that the operator feels that the machine belongs to him and that it "needs him." This feeling is akin to that of the driver toward his miniature sports car.

There is no question but that the future will require more productivity from more and more workers. This will be true in spite of the present trends toward more and more automation. The economic use of handicapped workers may well be a contributing factor in our race for survival and in holding or recapturing world markets.

Gadgets

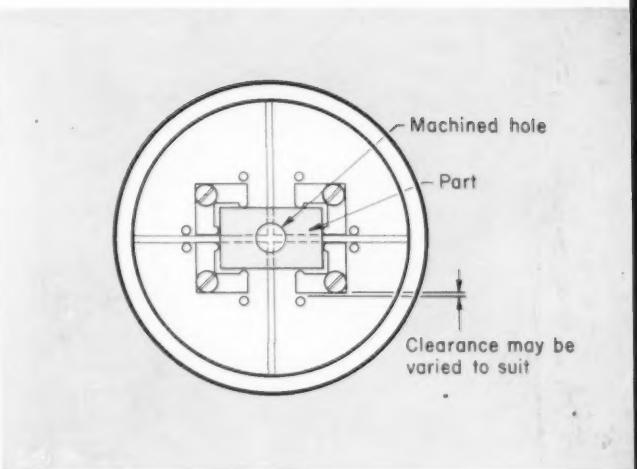
Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

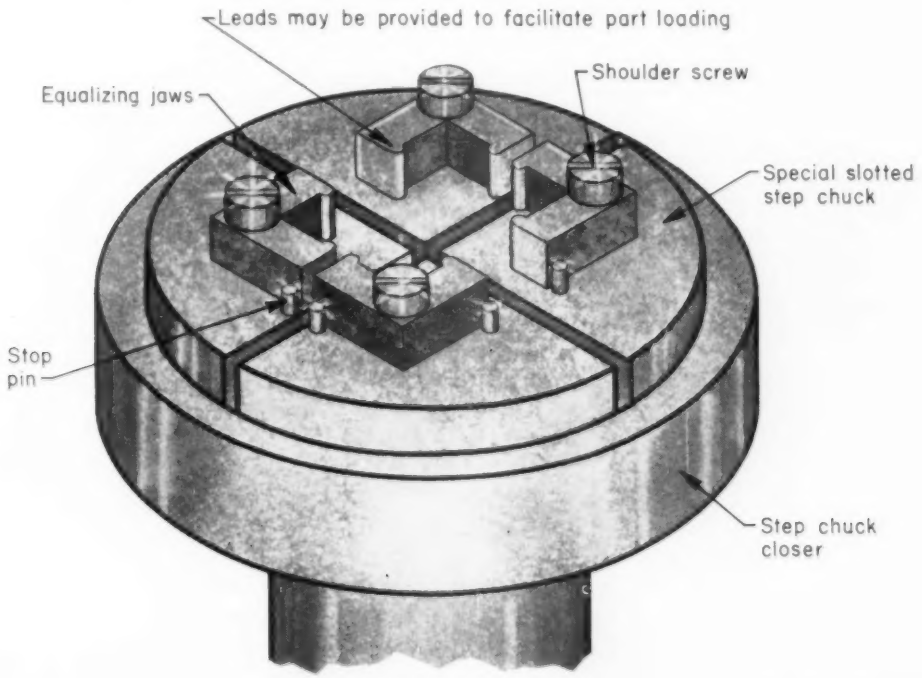
Self-Centering Device*

When a hole is to be machined in a center of a rectangular part, the part may be automatically centered on a lathe spindle with the device illustrated. A step chuck with four equalizing jaws which pivot about shoulder screws is used. The movement of the jaws is limited by stop pins. As the four-slotted step-chuck is drawn into the step-chuck closer, the equalizing jaws advance and pivot to contact the part on four sides with equal pressure. The amount of pivot will vary according to deviations in part width and length. Clearance between stop pins and equalizing jaws must be sufficient to compensate for part variations. This type of device can be used in conjunction with an indicator as a gage to check a hole location in a part after machining. It can also be used as fixture for assembling parts. Other configurations such as triangles, squares, etc. can be centered by simple changes in design.

Fred J. Schneider
Lehigh Valley Chapter

*Gadgets Contest Entry





Self-Centering Device

Progressive Forming Die

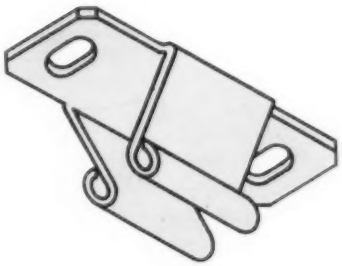
Forming operations which bend steel through an arc greater than 90 deg are normally accomplished without difficulty in single-operation dies. Similar operations are often impossible in progressive dies because of the general inability of these dies to accommodate mandrel stations. A useful alternative is unsupported forming, two examples of which are illustrated.

The drawings show curl formation, a common pressworking operation. With assistance from the first form station, the second stage reverses metal direction nearly 360 deg.

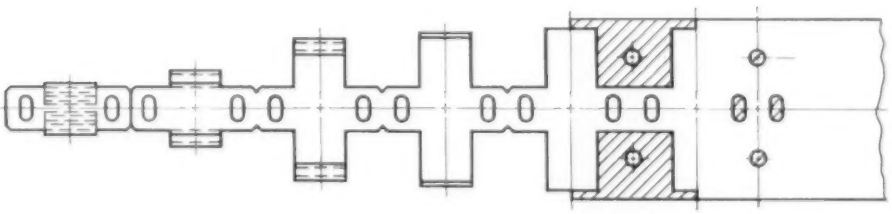
Another example shown is the final form and cutoff operation which cuts the part from the strip and bends the tabs 30 deg past vertical. Formed to 90 deg in the preceding station, the tabs are simply pushed down against blocks which establish the specified angle.

A design of this type is not only effective—it is simple, inexpensive and provides easy correction of springback errors.

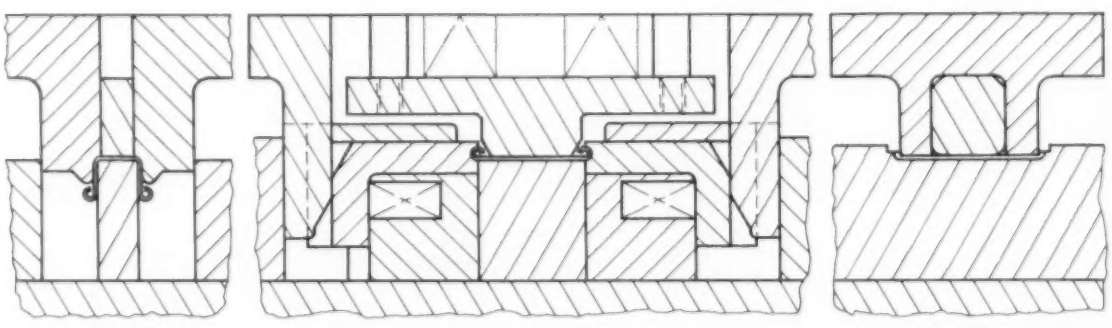
Paul W. Kutschera, Milwaukee Chapter

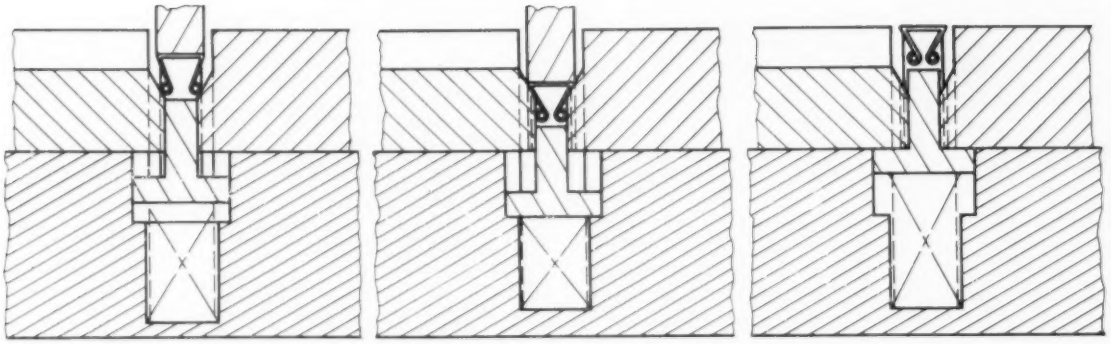


Workpiece



Strip Layout





Final Form

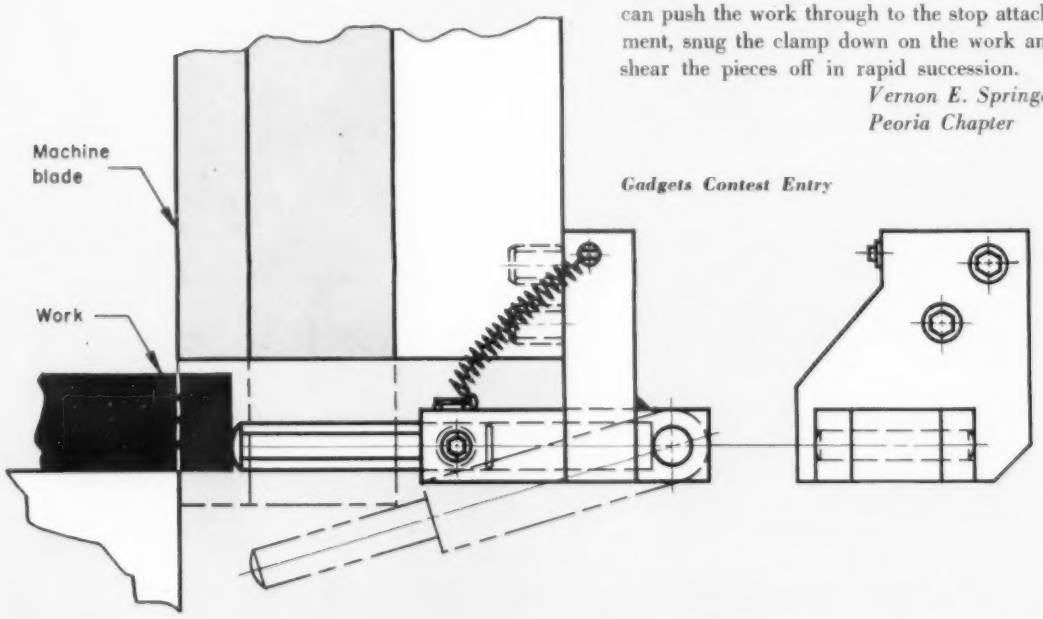
Stop for Punch and Shear Machine*

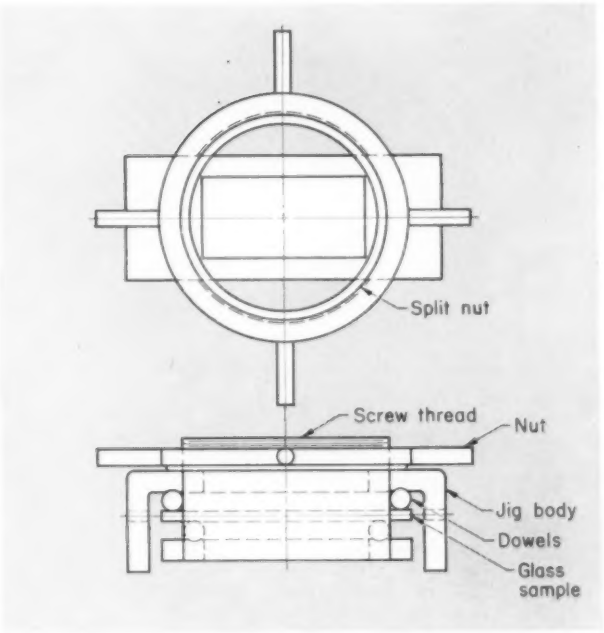
Sometimes the stop attachment that comes with a combination shear and punch machine must be somewhat remote from the shearing blade because of the width of the blade. The attachment illustrated can be used on these machines to cut short pieces. It is designed with a spring so when the blade starts shearing the work it pushes the stop down at the same time. When the piece is sheared off, the stop springs back into normal position ready for the next piece. When the job is completed the attachment can be taken off the machine until the necessity of cutting pieces under three inches length recurs. It can be attached with cap screws and detached in a very short time.

Use of the stop saves having to measure the length of the work as it is pushed through the machine. With the attachment one man can push the work through to the stop attachment, snug the clamp down on the work and shear the pieces off in rapid succession.

Vernon E. Springer
Peoria Chapter

Gadgets Contest Entry





Glass Testing Jig

Glass testing samples are checked quickly under tension or compression with the jig illustrated. The glass sample is placed in the jig through a slot in the base. The dowel pins are placed in the jig above and below the glass. The pins can be welded in place if desired. A dial indicator gives a reading of deflection as the screw is tightened allowing a determination of the breaking point of the glass. When running scratch tests, the reading on the dial indicator is used for determining relative compressive or tensile load. Other possible uses of the jig include testing of ceramics, steels and plastics.

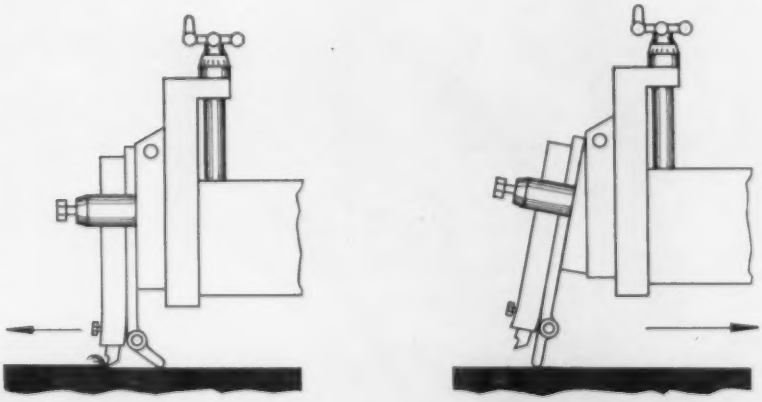
James W. Schmaus
Pittsburgh Chapter

Tool Lifting Device*

Life of shaper or planing tools can be extended by using the device illustrated. The gadget consists of a piece of flat mild steel to which a hinged finger of case-hardened steel is attached. It is clamped together with a toolholder onto the machine toolpost. On the working stroke of the machine, the finger inclines to the rear out of the way leaving the tool free to cut. On the return stroke, the finger lifts the tool clear of the work, thus preventing the tool from dragging over the work surface.

G. A. Kendrick
Sydney, Australia Chapter

*Gadgets Contest Entry



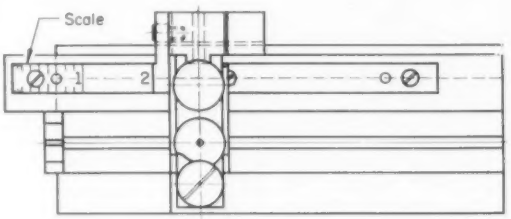
Gadgets

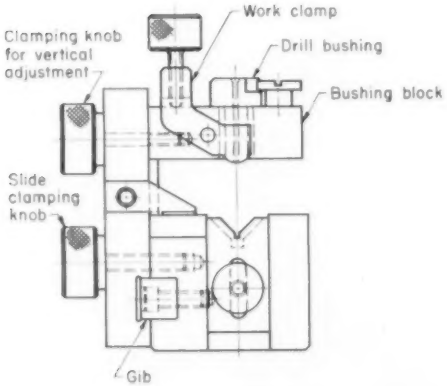
Universal Drill Jig*

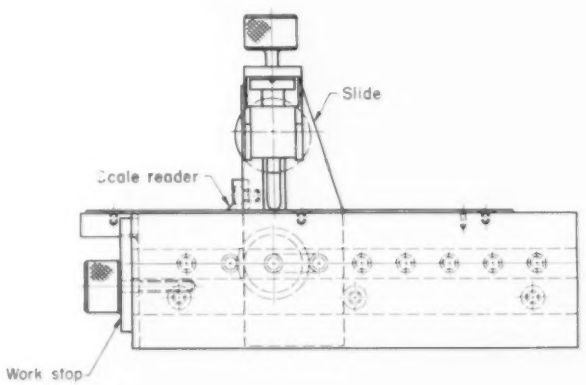
When it is necessary to drill small diameter holes in round parts and production volume does not justify special tooling, the universal jig illustrated can be used. The jig is designed to accommodate shafts up to one inch in diameter, with or without machined shoulders. A workstop, adjustable vertically, is used on parts where the hole is located a specified distance from a shoulder. It also serves as a support for the smaller diameter when the hole is to be drilled in the shoulder. A bushing block, also adjustable vertically, is set as required to accommodate different work diameters. To locate the bushing block horizontally, it is slid along a gib and clamped in the proper position as indicated by a scale. If the scale setting is not accurate enough to suit the job, design may be modified so that size blocks can be used to set the bushing.

Robert M. Dickson
Springfield (Mass.) Chapter

*Gadgets Contest Entry



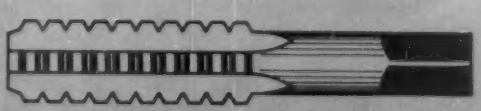


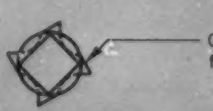


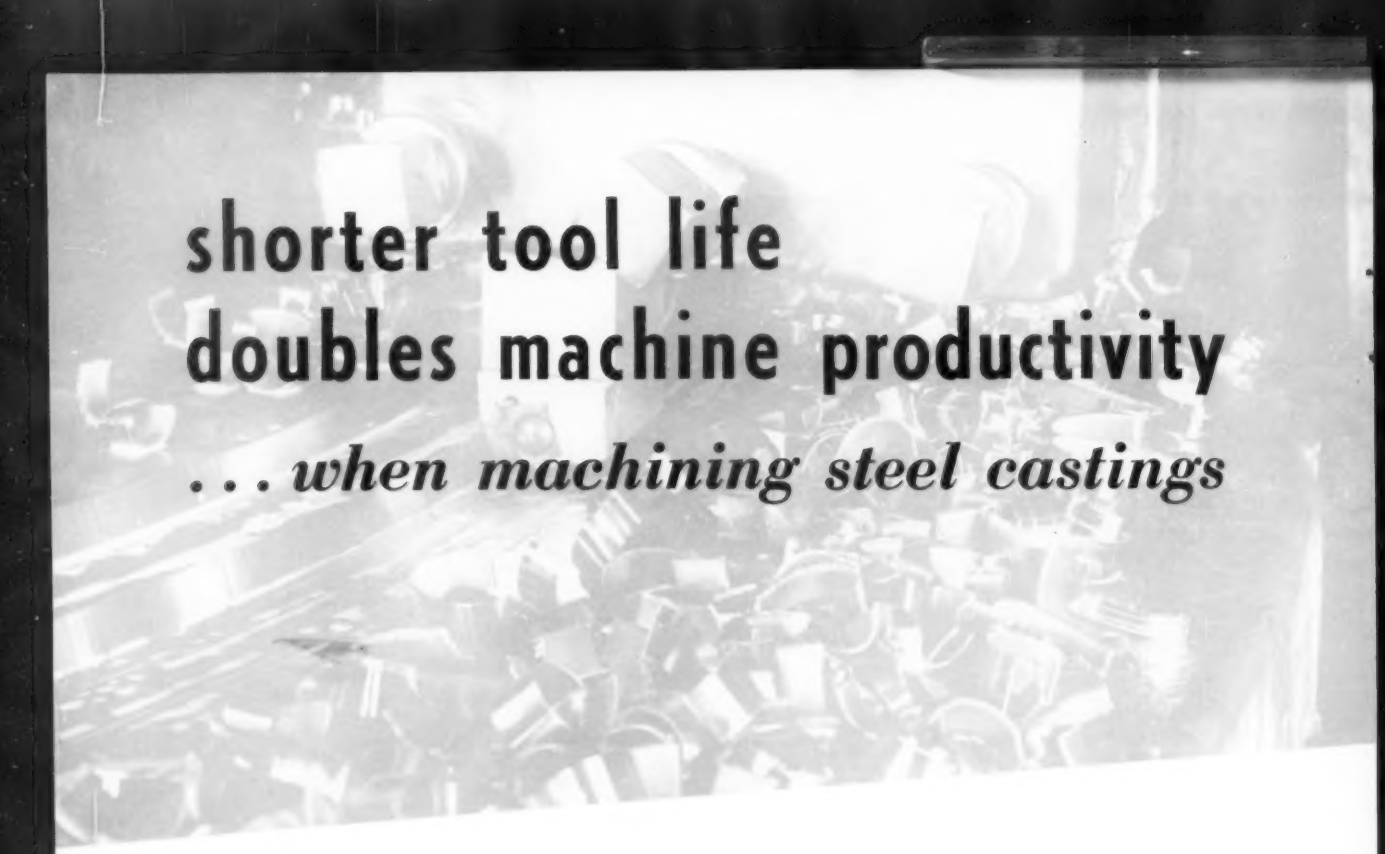
Use for Old Taps

Taps are subject to excessive wear and short life when used for tapping prehard steel or other hard materials. Often, breakage results due to dulling and greater torque required to pull the tap. To prolong tool life holes may be pretapped with an old tap ground to one-half the original thread depth as shown. Since taps dull mostly on the tip of the thread, the lower half remains in good condition. The hole is first tapped with the half-thread tool then final tapped to a standard full-thread. In unusual cases, several preliminary taps can be used before final threading.

John Breen, Pittsburgh Chapter







shorter tool life doubles machine productivity

... when machining steel castings

By Frank L. Brugger*
Kennametal Inc.
Latrobe, Pa.

Many companies "baby" cutting tools to obtain long tool life. In the machining of cast steels, cutting at higher speeds shortens tool life but the increased tool costs—measured in hundredths of a cent per minute—are an investment that pays off in dollars.

MACHINING OF EXOTIC MATERIALS, such as those used in aircraft and missiles, presents many more problems than the machining of cast steel. Nevertheless, because of the great volume of cast steel that is machined in this country, more time is spent in machining cast steel than is spent in machining all of the newer materials combined.

Because of the economic benefits to be obtained by improving the efficiency of cast steel machining operations, a research program was undertaken to determine how machining costs could be lowered and how serious tool problems and tool failures could be overcome. As a part of the program, tests were conducted with the cooperation of several companies that machine cast steel on a high-production basis. Efforts were concentrated on actual everyday machining problems, rather than on the metallurgical properties of the material being machined. However, it should be mentioned that for best machinability, all steel castings should be annealed or normalized prior to machining. Welds, particularly, should be normalized to improve machinability.

Casting Quality: The tests showed that problems encountered in machining cast steels are somewhat similar to those encountered with wrought steels. Due to the greater runout on castings, however, the tool must repeatedly enter and leave the cut through the hard outer skin that is on all castings of this type. Runout should, of course, be kept to a minimum. The more a tool is required to travel in and out of a cut, the shorter the tool life. Whenever possible, the cutting tool should be kept at least ⅛ inch below the surface of the casting.

Poor surface conditions can be caused by the design of the casting itself, by molds that do not leave a sharp impression, or by carelessness. Inclusions such as sand, slag and mold wash cause machining difficulties that cannot be overcome, even with the best tooling available. Frequently, inclusions can be confined to areas in the casting where

*Senior member ASTME Milwaukee chapter.
From Paper 249, "Machining of Steel Casting Surfaces," presented at the 28th ASTME Annual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.

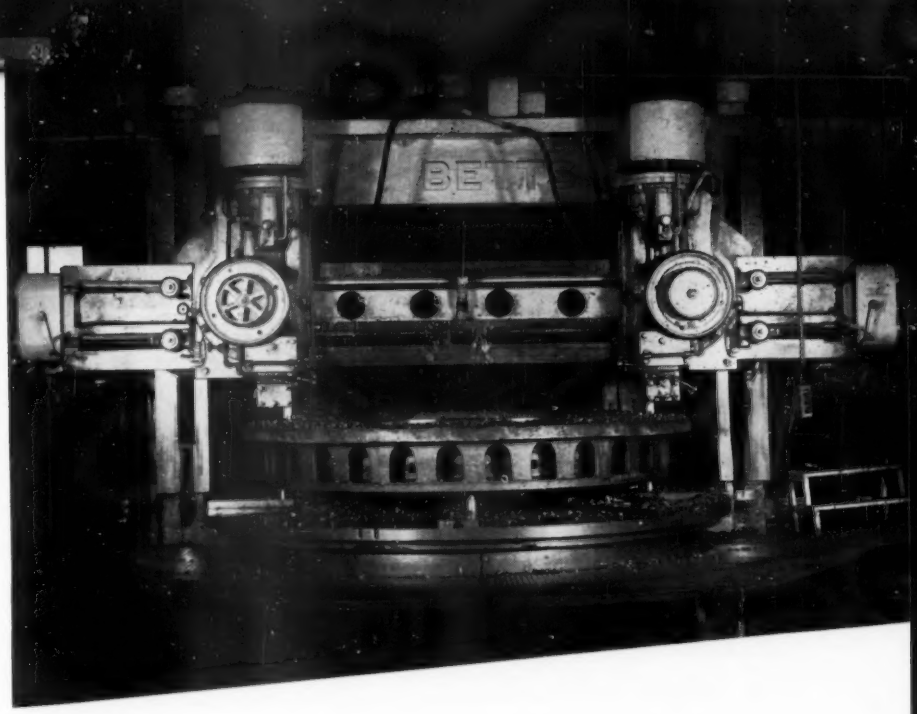


Fig. 1. Machining of a steel casting on a 12-foot boring mill.

they can be readily removed by a roughing cut.

For economical machining, poor surface conditions should not exceed 3/8 inch depth. While low-quality castings may cost less than high-quality castings, machining difficulties make low-grade castings expensive in the long run.

Surface Preparation: Flame-cut surfaces can be machined without too much difficulty when the surface has been properly prepared. Droplets of metal deposited during flame cutting should be removed before machining so that there is no danger of any movement of pieces of metal ahead of the cutting tool. When flame-cutting a casting, care should be taken to not cut so deep as to require a cutting tool to pass in and out of the cut. It is much better to leave an extra 1/4 inch of stock on a casting than to have the cut not clean up.

Most operators have a tendency to reduce machine speed when intermittent cuts are encountered. It should be remembered, however, that the slower the speed, the greater the impact on the cutting tool. It is better to run intermittent cuts at speeds in excess of those ordinarily used for continuous cuts.

Running at too slow a speed will also cause chips to stick to the cutting edge of the tool. Pinching of chips between the tool and the workpiece invariably causes tool failure. Operations requiring intermittent cutting can often be performed by running at speeds 75 percent to 100 percent greater than those used for continuous cutting.

Production Tests: Large steel castings present more machining problems than small castings, due to the greater runout and the (usually) flame-cut surfaces. A number of tests were run with such workpieces. Machining of one part, a large shovel ring, on a 12-foot Betts vertical boring mill is shown in *Fig.* 1. This casting is of a medium-manganese molybdenum low-alloy steel in the annealed state, Bhn 300-321.

The heavy-duty toolholder, *Fig.* 2, has a two-inch square shank suitable for heavy roughing cuts, *Fig.* 3. It accommodates a B-1510 insert, Kennametal grade K2S. Five-degree negative back and side rakes are used. The cutting insert is supported by a solid carbide shim. This shim places the cutting insert under compression when cutting forces are exerted, which is the ideal condition for longest tool life.

A solid carbide chipbreaker is placed on top of the cutting insert. Since this chipbreaker is clamped, rather than brazed, there are no brazing strains.

Mechanical tool holders of this type gave excellent results during the tests. There are, however, several precautions that should be observed. It is important that the shim and cutting insert be absolutely clean when assembled so that full contact is made between the shank, shim and insert when they are clamped in the holder. Small chips on these surfaces prior to clamping will cause uneven strain that may fracture both the carbide shim and the disposable insert. When clamping, the pressure that can be exerted by hand on a wrench is sufficient. More pressure could prove troublesome.

In running the tests, the cast steel was cut both with and without coolant. Slight differences were apparent in the chips but the chips were sufficiently large to absorb and carry off the heat being generated in the cut.

As shown in *Fig.* 3, the chips were in the shape of an open figure six, which indicated that a free

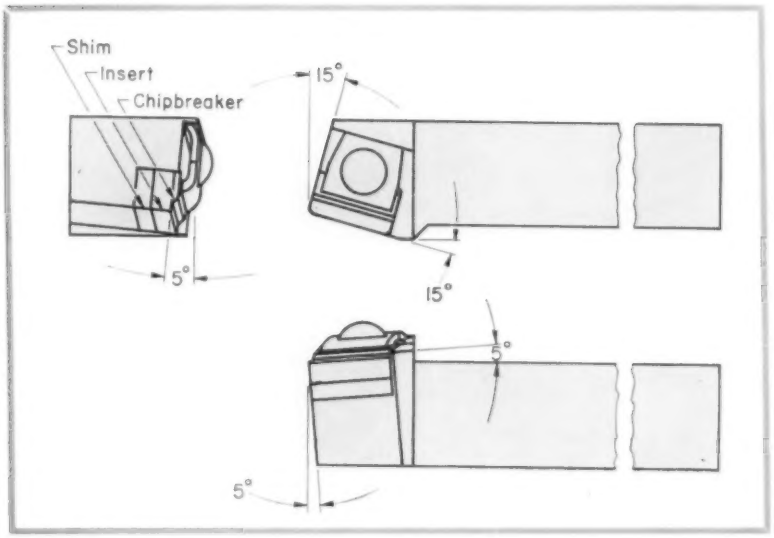


Fig. 2. Design of toolholder for taking heavy cuts in steel castings.

Fig. 3. Tooling for machining a large steel casting. Shape of chip indicates that a free cutting action is taking place.

cutting action had taken place and the chips were crimped just enough to cause them to break. Tighter crimping of the chip would have tended to overload the cutting tool and the accompanying higher cutting forces might have caused damage to the tool. Cutting was at 212 fpm with an 0.032-inch feed. Depth of cut averaged ¾ inch, although in some areas of the casting it reached one inch.

Honing: The tests demonstrated that the proper honing of tools is the most important factor in obtaining long tool life. Since carbide is a pressed and sintered material, the edges are the weakest point. If allowed to break down naturally when cutting, edges can flake out and destroy the effectiveness of the tool. Honing to prevent this flaking extends tool life by 20 to 50 percent.

A small hand hone is best for honing carbide tools. It is not necessary to use diamond-impregnated hones for this purpose.

In honing, the edge of the carbide insert should be stroked at a 10 to 15-degree angle with respect to the top of the insert and in such a manner as to form a 0.002 to 0.005-inch radius on the cutting edge. Generally small radii are best for finish cuts; large radii for heavy roughing cuts. Care should be taken not to hone a full radius on the cutting edge; this will destroy the side clearance.

Getting Greater Productivity: Use of high-quality castings, well-designed and properly honed tools, and maintaining adequate feeds and speeds all help to minimize downtime and to increase productivity. Throwaway inserts, by reducing tool change time, also contribute importantly to increased productivity. The greatest improvement in productivity can be obtained, however, by increasing cutting speeds.

Machine output has been doubled, in some cases, by cutting at higher speeds. One company increased production from 8 to 16 castings per shift by using higher cutting speeds. At the same time, cost per piece was reduced from $9.14 to $4.88, despite an increase in tool cost from $0.14 to $0.77 per hour. Details of the operation are:

Machine	54-inch Bullard Cutmaster, 40 hp
Material	Steel casting, 43-inch OD, 22-inch ID, 14-inch length
Hardness (Bhn)	223
Operation	Turn and face
Toolholders	KSBR-86 (turn), KSBL-86 (face)
Feed (ipr)	0.031
Depth of cut (inch)	0.25 (average)
Type of insert	SNG-634, Grade K21, negative rake, square, with eight cutting edges

Originally, tool life was 120 minutes. Increasing the cutting speed from 170 fpm to 410 fpm reduced tool life to 22 minutes but the added tool cost was more than compensated for by the increase in machine productivity. Machining time per piece dropped from 52.5 minutes to 21.5 minutes. Since clamped carbide inserts are used, downtime for tool changes is not a problem. The inserts can be indexed to give a new cutting edge in a few seconds.

The tests proved that sacrificing long tool life to gain higher efficiency from expensive machines and trained operators provides an opportunity to make an investment in pennies that pays off in dollars. Not only are piece costs reduced, but machining capacity is increased, without an investment in additional capital equipment.

Ultrasonic Pickling Speeds Scale Removal

Gas turbine engine parts are cleaned in 30 seconds by an ultrasonic pickling unit in use at the Lycoming Div., Avco Corp. The contaminant removal process formerly utilized required one and one-half hours of soaking.

Designed by Lycoming, the double-boiler pickling installation uses equipment built by Branson Ultrasonic Corp. to provide cavitation in the pickling acid. Forty-kc energy is generator-delivered to a series of eight transducers mounted against the inside wall of the outer tank. The transducers convert the electrical oscillations into mechanical vibrations of the same frequency, energizing the water in the outer tank. The vibrations are coupled into the inner tank of the installation through degassed water that contains a wetting agent, ultrasonically agitating the pickling acid in the inner tank without contact between acid and transducers.

Cold water circulating through the coils in the outer tank keeps transducers sufficiently cool to prevent depolarization. Two interlocks assure proper transducer function. Steam coils lining the acid tank heat the 30 percent phosphoric acid cleaning solution to 160 F. A thermal cutout shuts off plate power when tank temperature rises above that degree of heat.

Ultrasonic pickling, even for heavily contaminated parts, requires only three simple steps: an ultrasonic bath to prevent fouling of the vapor blast medium; vapor blasting; and return of parts to the acid tank for final cleaning. This procedure requires no more than three minutes per load, provides substantial acid saving, and thoroughly cleans all exposed surfaces of the most intricate part.

DOES GUN

Gun drilling, gun boring and gun reaming are fast and give precision results. Machine tool and fixturing costs are higher than with conventional methods. Some of the economic pro's and con's are discussed by the author.

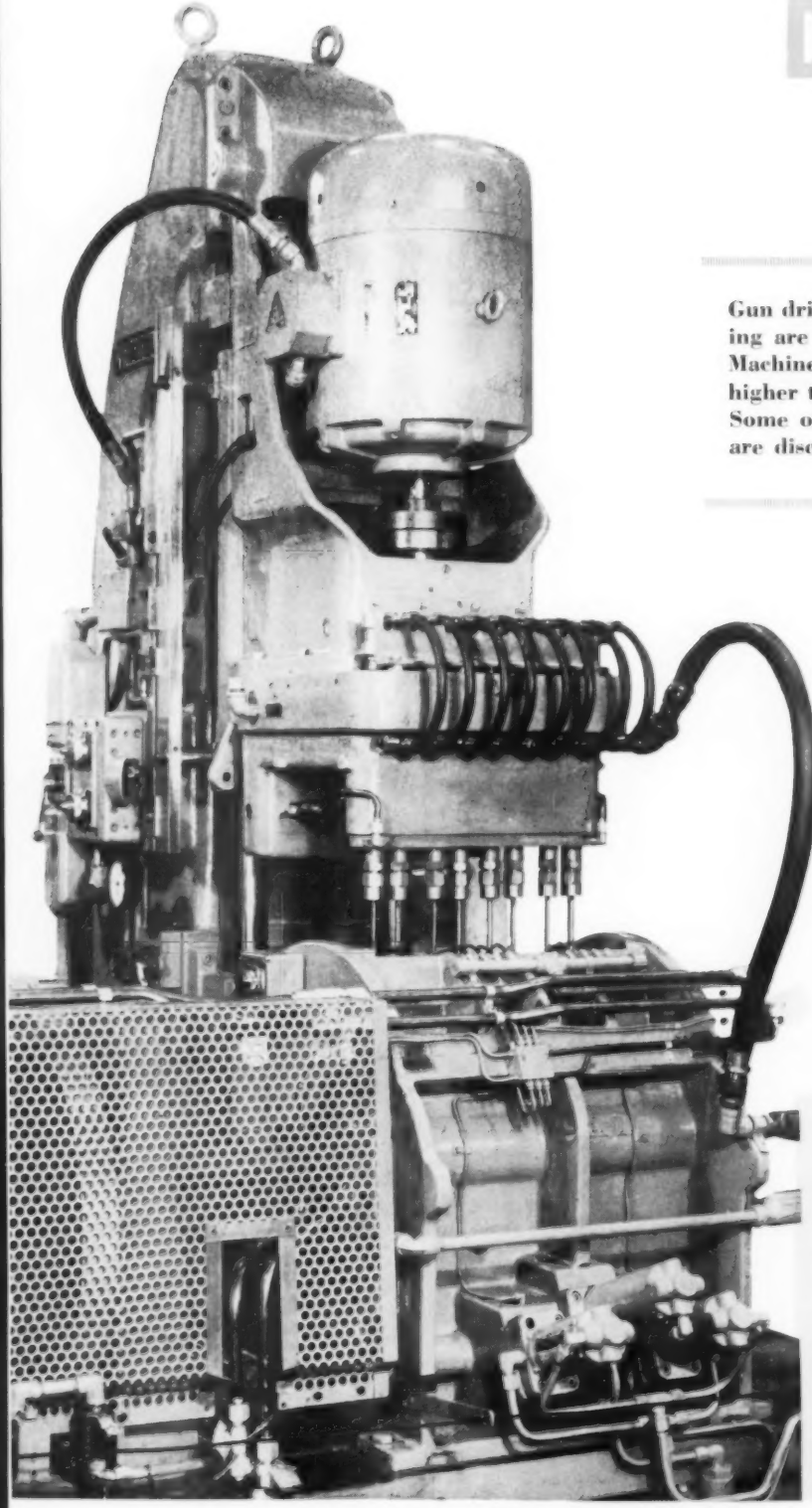


Fig. 1. Short cycles are obtained by using gun drilling techniques to machine valve guide holes.

DRILLING PAY?

By R. Eugene Delamater
Vice President
The Foote-Burt Co.
Cleveland, Ohio

WHENEVER PRODUCTION WORK requires deep holes, close tolerances, or good surface finish and short work cycles, gun drilling techniques appeal to tool engineers. Whether the use of a gun drilling machine, as shown in *Fig.* 1, is practical or economical depends on how much the advantages gained by gun drilling might be offset by additional capital investment in special machine tools.

Production Advantages: To obtain short machine cycles for deep holes, gun drilling permits feed rates 300 percent greater than conventional methods. When several machines are being used to obtain a short cycle by making multiple passes in the same hole, they can often be replaced by one gun drilling unit. Savings in floor space also result. If accuracy requirements are not extreme, the use of gun drilling can avoid the need for reaming operations.

In addition to gun drilling, gun boring and gun reaming offer distinct production advantages. Gun boring produces an accurate hole with a quality finish and requires less coolant capacity than gun drilling. The size of the coolant system required is correspondingly reduced. Gun reaming has similar advantages.

To produce a hole that has extreme accuracy, straightness and finish requirements on multiple head layouts, two cuts are required. For example, the machine shown in *Fig.* 2 gun drills valve guide holes from the solid at one station and finish reams at the last two stations. Experience on another application, gun boring of castings, revealed that core shift had a bad effect on accuracy. For extreme accuracy holes, the first operation can be drilling or boring, with attention concentrated on removing metal and locating the hole within reasonable tolerances. With gun reaming as a second and separate operation, attention can be concentrated on achieving straightness, position, diameter and finish.

Spindles, Coolants and Fixturing: Machines for gun drilling and gun boring must be equipped with high-speed precision spindles. A rigid machine is needed to absorb any vibration due to the high speed of the spindles. Whenever possible, the spindles should be belt driven, as

From Paper 276, "Machine Tool Requirements in Multiple Gun Drilling and Gun Boring Operations," presented at the 28th ASTME Annual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.

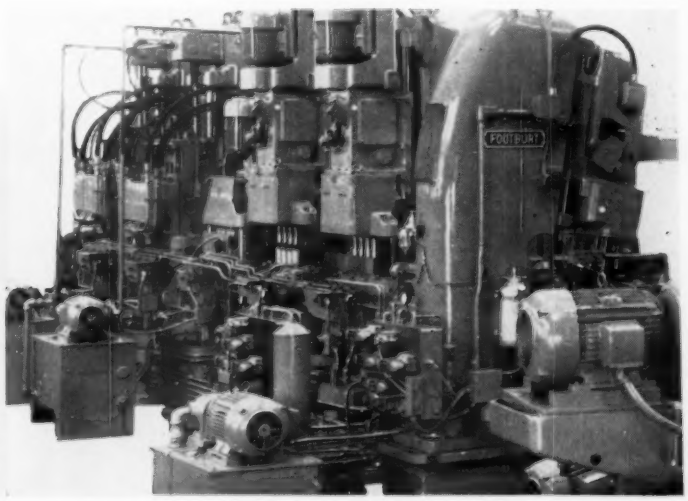


Fig. 2. By gun drilling from the solid at one station and gun reaming at the two subsequent stations, extreme accuracy and finish requirements can be met in production.

shown in *Fig.* 3, but in multiple gun drilling with an irregular layout of spindles, belt drives are not possible and precision gear drives must be used. Guide bars to line up the multiple head with the fixture do not add to machine rigidity, but do hold gun drills in alignment with the bushings.

Since coolant is forced through the gun drill to dispose of chips, a high-pressure coolant system is required. For multiple gun drilling an irregular pattern of holes, a revolving coolant seal is placed at the back end of the spindle to make it accessible for maintenance and replacement. Making such a seal small in diameter increases its efficiency. Manifolding can be used, but limits accessibility. When the revolving seals are place on the spindle nose for accessibility, design problems can arise in maintaining the required distance between spindle centers. The machine itself should be designed to permit coolant and chips to flow freely.

For a group of machines, a central coolant system is used. For a single machine, an independent coolant system is placed alongside the machine, as shown in *Fig.* 4. The system usually consists of a small drag-link sludge conveyor that deposits chips and sludge into a movable container. Coolant then flows over baffles to a point where it is pumped through a filtering system. A magnetic chip separator is sometimes part of the coolant system. Filtering systems can use sheets of paper or cloth for filtering, or a filtering tank with cylindrical replaceable cartridges.

In fixturing, bushings should be located as close to the work as possible to obtain the best results. They should be held stationary. It is preferable to move the work to the bushing rather than move the bushing to the work when the bushings must extend into a well. When possible, it is best to start the gun drill from finished metal rather than rough scale. Fixturing should be designed to clear the chips and coolant with as little coolant flushing as possible to hold the coolant capacity required for a machine to the minimum.

Economic Feasibility: Several factors must be considered to evaluate the economic feasibility of gun drilling. The advantages of gun drilling are short cycles, fewer passes, fewer machines, savings in floor space, gains in finish and accuracy. These must be weighed against the costs of high-speed precision spindles, revolving seals, rigid machine tools and coolant systems.

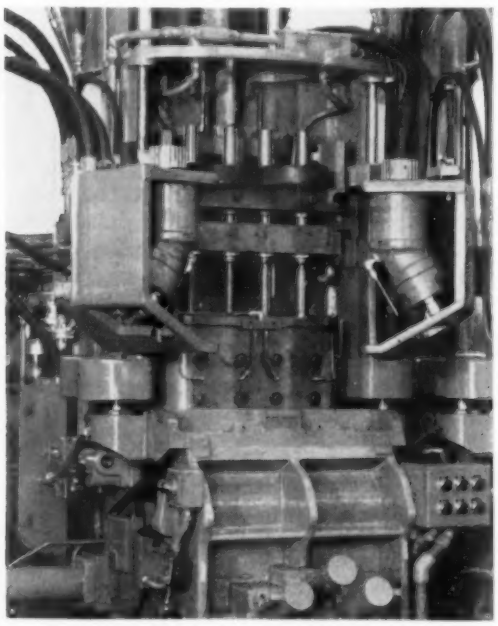


Fig. 3. (above) Fluid motor carriages are swung open to show belt drive design recommended for gun drilling machines.

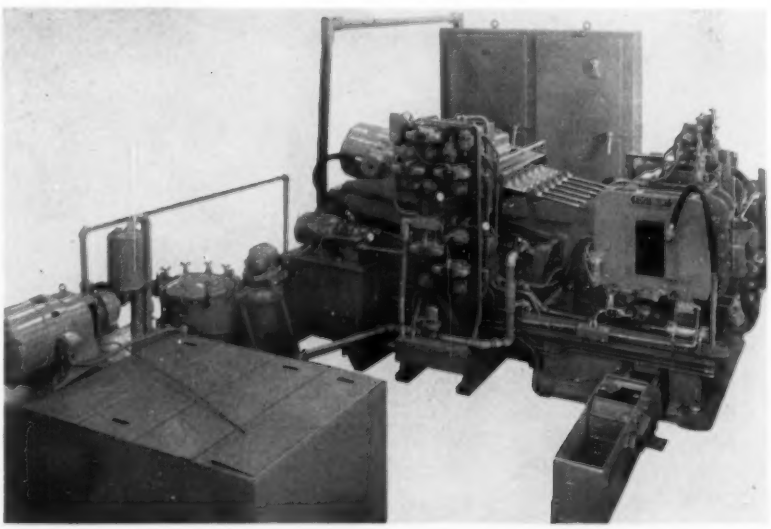


Fig. 4. Individual machines, such as this six-spindle gun boring machine, should be equipped with their own coolant systems.

locating points in the Space Age:

NUMERICALLY CONTROLLED INSPECTION

By J. Stewart Broateh
Pratt & Whitney Co., Inc.
West Hartford, Conn.

Without using special setups or gage blocks, the numerically controlled gaging system described by the author can repeat measurements within 25 millionths of an inch. A computer determines coordinates of any required point on a complex surface, numerical control locates the stylus at the point and electronic gages sense deviations that automatic output equipment records.

PLACING AN OBJECT at a specific point in space, automatically and with high accuracy typifies the task of the Space Age, whether the object be a rocket in trajectory or an inspection probe on the surface of some complex workpiece.

Six-Coordinate Inspection System: For gaging points in space, the numerically controlled gage shown in *Fig.* 1, provides its own master, operates from taped instructions and prints out its findings. Because of its ability to operate with very little supervision, make decisions and control its own operation, it is actually a gaging system. The system operates as an independent and rigorous inspector of complex machined shapes. For instance, when a part is gaged, then submitted to operating conditions and resubmitted to the gage system, the first gaging positions are repeated to 25 millionths of an inch, using the original tape. Findings are automatically recorded without human transcription errors for comparison with the original inspection. The gaging system does not require special setups, gage blocks or special masters.

Typifying the complex type of gaging job for which the system was developed is a hollow hemisphere, *Fig.* 2. To gage wall thickness at any given point on the surface of the hemisphere, six movements are controlled under tape. Each gage head is tilted so that it is normal to the tangent at the point gaged, the upper head is moved in X and Z directions, the lower head is moved in Z, and the workpiece is moved in X and rotated about its own axis. The gage heads are connected together to indicate the algebraic sum of their readings. Gage readings are automatically recorded.

Core of the system is a master bar. This bar, of solid stabilized stainless steel is a series of ½-inch blocks spaced at ½-inch intervals, as shown in *Fig.* 3. The raised ½-inch sections are "read" by an electromagnetic head containing two balanced coils that compose the two arms of an external bridge circuit. When the head is centered exactly over the

From Paper 247, "Numerically Controlled Inspection Techniques," presented at the 28th ASTME Annual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.

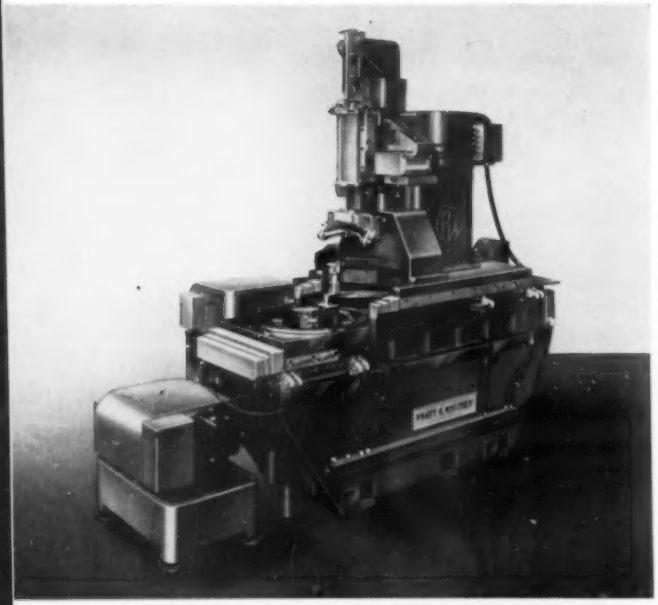


Fig. 1. Six-coordinate gaging system operates under numerical control with automatic recording of gage head outputs on charts and printout.

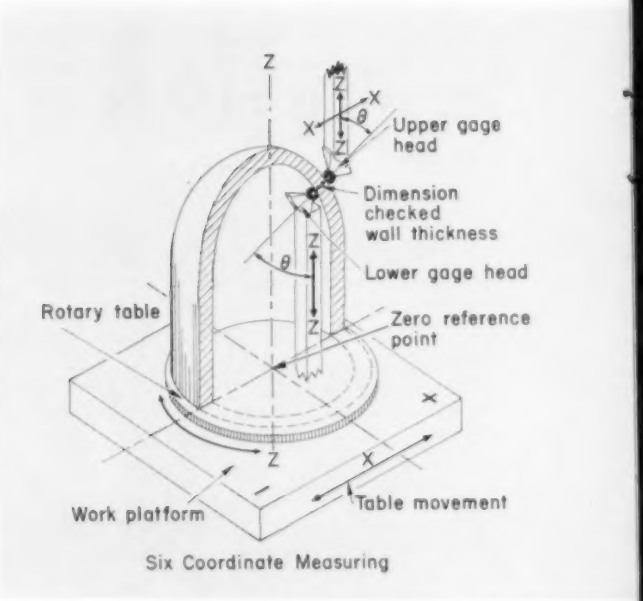


Fig. 2. Measuring wall thickness of hemispheres, cones and cylinders is typical, but many other shapes can be gaged by the system.

raised section, output from the coils is null. By the geometry of the master bar, the sensing heads will thus detect null at 1-inch intervals. Each individual block is calibrated during manufacture so that total accumulated error in a 60-inch bar is less than 30 millionths of an inch.

The reading head itself is mounted on a small slide driven by a micrometer screw. Total travel of the micrometer screw is one inch, in increments of 0.0001-inch. By this means, any point along the axis travel is located by incrementing in two stages. The fractional amount of a coordinate is set by moving the micrometer screw, the integral amount by passing through null the requisite number of times. By locating the coordinates of a point in several axes, the point is located in space.

Under automatic control, the tool slide and micrometer are moved by closed loop servos as shown in *Fig.* 4. To locate a point at some distance from reference zero, the instruction is separated into a course command and a fine command. The fine command drives the micrometer screw and the course command drives the tool slide. The coarse positioning system ignores all nulls except the one set by the tape. When the tape-set null is detected, the gages are in the commanded position. This sequence is repeated for each axis—move the table in *X*, outside head in *X* and *Z* and inside head in *Z*.

System Operation: Three major functions are preformed by the system: positioning the gage heads, gaging and recording the gage readings. The product, a recording of wall thickness at many points may be obtained by any one of three modes of operation: manually, by dial control, or by tape control. In each mode the same jobs are done—position, gage and record—but the source of command information is different.

To gage wall thickness at a specific point, several machine movements can be required.

1. Position workpiece in the *X* axis, rotate as required
2. Position inside gage head normal to surface at point (θ, Z movement)
3. Position outside gage head normal to surface at point (θ, X, Z movement).

For the operator manually to position one slide after the workpiece is in place and the slides zeroed, the fine and coarse positioning sequences are required. To move the table 2.3456 inches for example, the operator first turns the micrometer to read 0.3456, which offsets the sensing head by this amount. Second, he moves the table until the coarse position indicator reads 2.3. The meter, during this movement nulls at 0.3456 and 1.3456 as the sensing head passes through these one-inch intervals. The operator adjusts the table until the meter indicates null at 2.3456 inches.

Coarse and fine positioning sequences are made similarly for the other machine axes until the gage heads are located properly in space to read wall thickness. When all axes of the machine are positioned, gaging is triggered and recorded.

For operation using the dial as in input, the

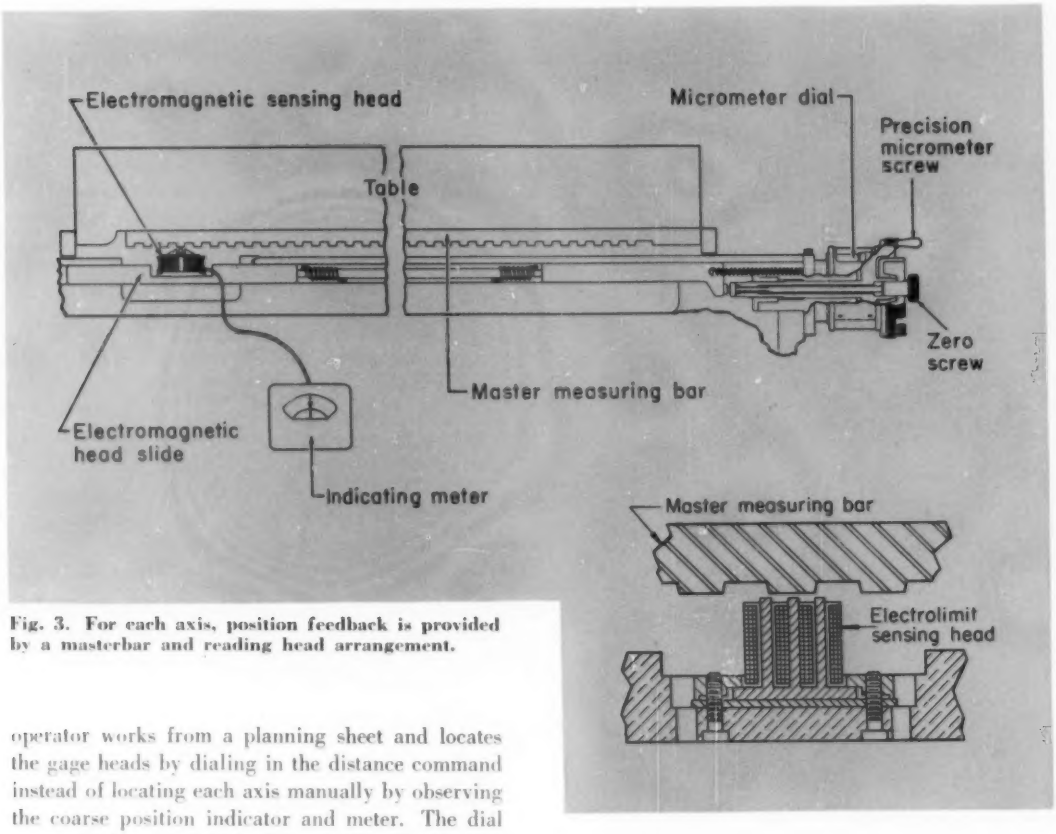


Fig. 3. For each axis, position feedback is provided by a masterbar and reading head arrangement.

operator works from a planning sheet and locates the gage heads by dialing in the distance command instead of locating each axis manually by observing the coarse position indicator and meter. The dial is mounted in the console shown in *Fig.* 5 and gives the operator direct access to the control logic, bypassing the tape reader. The dial input enables him to position each axis in succession by simply dialing the distance commands. To place the table at 2.3456 inches from zero reference, the need to hand-operate axes and check indicators is eliminated by using the telephone type dial. This is a definite improvement over manually operated machines.

Under tape control, command information for gage head position and sequence is entirely contained on the tape. To prepare the tape, a planning sheet and IBM 610 computer are used. It is sometimes felt that computers are not needed for positioning work, but for this system, the computer helps achieve greater over-all economy. The gaging job is complex. Six machine movements can be required for each gaging position. The workpiece can be described by polar coordinates whereas the machine axis system is cartesian. The angle for the gage heads at gaging position must be found perpendicular to the tangent at the point being gaged. A required datum point to be gaged sometimes is not indicated but described as lying between two indicated points. Interpolative mathematical techniques are required to assign the correct value to such datum points. Such data preparation is usually done more accurately and economically by computers than by engineering personnel. The computer also lessens lead-time and eliminates several potential sources of error as well.

By using the computer the first phase of work prior to actual gaging is made more efficient and economical than is possible with nonnumerically controlled gages. The tool engineer plans the gaging, indicates the preferred sequence and turns calculation drudgery over to the computer for tape preparation.

The computer-prepared tape is then loaded into the gage control unit and commands to gage slides are dumped into control logic from the reader more efficiently and accurately than is possible with the telephone dial. One block of information, digitally coded on 1-inch wide tape positions all the machine slides to the programmed positions and tilts the gage heads at right angles to the workpiece surface.

When the slides and gage heads are correctly positioned, a signal is given to connect gage head output to two *XY* recorders. The recorders are connected to record the deviation from nominal size against angular position of the workpiece. One recorder is fed from the inner gaging head and the other recorder is fed by the outer gage head.

Gage head output also drives digital output equipment to operate printout typewriters and tape

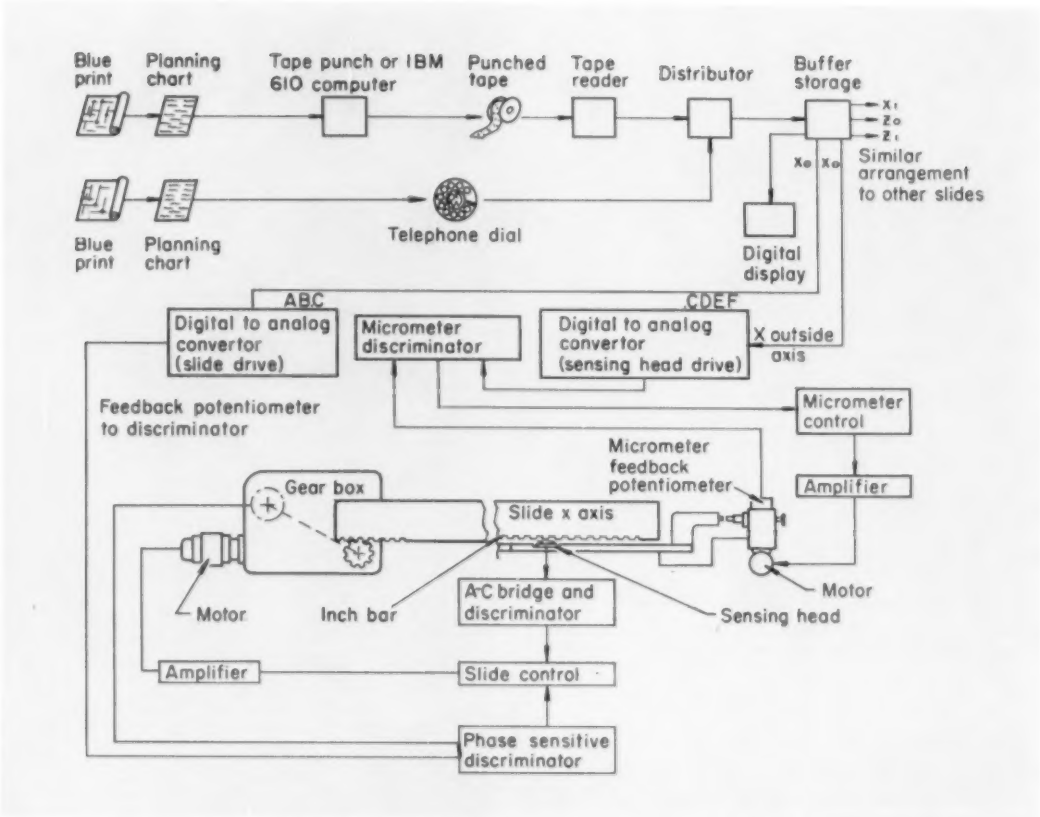


Fig. 4. Dial or punched tape inputs drive both coarse and fine positioning of the machine axis.

Fig. 5. Plotters on the console record deviation against angular position of the workpiece for both the inside and outside gage heads.

or card punches. Starting at the equator of the hemisphere, the inner and outer gage heads can be tape-directed to move upward in increments and the hemisphere rotated until wall thickness has been gaged as closely as necessary. As the gaging proceeds under numerical control, printouts and *XY* plots are made with no human intervention. For a similar workpiece, the same tape can be used and the recordings compared. Or the piece can be submitted to service for a period of time, withdrawn from service and regaged. The original and second gage recordings can be compared to determine what changes in the part were incurred by service.

Because the same tape program and the same master bar are used in each gaging, many variables in comparison are eliminated, assuring that before-and-after or part-to-part comparisons are more accurate than by other gaging methods. Over-all accuracy is expressed as $E = 40 + 2D$, where E is the positioning error in microinches and D is the distance moved. For a 20-inch movement, the gage stylus arrives within 80 millionths of an inch of its true destination. Gaging is repeatable within 25 millionths of an inch.

Fig. 6. Two-axis gaging system for inspecting templates. Deviations from nominal are automatically recorded on charts and printout.

The six-coordinate inspection system was designed primarily for the inspection of rotated parts such as hemispheres, cones or cylinders, but because of the flexibility allowed by six axes of control and tape programming, the system is capable of gaging many different configurations.

Two-Coordinate Inspection System: For gaging points in space that fall along the surface of a template, another machine, *Fig.* 6 was designed by Pratt & Whitney for numerical control operation with chart and typewriter records of the gage head output. Being a two-axis inspection machine, it is simpler than the six-coordinate system but operates on similar principles.

Paper tape, punched in a digital code directs axis movement of this machine. Closed loop servos position each axis by referring to the master bar and coil output. The two axes controlled are the table and carriage, *X* and *Y*. A template to be inspected is fastened to the table with its edges vertical. A gage is mounted on a spindle inside a quill which moves vertically. The spindle can rotate 1½ turns and is designed to search out the minimum reading of the gage head as it contacts the template. Deviation from nominal is recorded on the chart and typewriter printout.

These gaging systems exhibit advantages peculiar to numerical control: facility in accepting computer-prepared input data, accurate and fast execution of commands, freedom from operator influence and high repeatability. Coupled to this are the advantages provided by electronic gages: accurate performance and ease in driving a variety of outputs. The self-contained master bar eliminates the need for gage blocks or special setups.

Combining these characteristics into an integrated system provides tool and manufacturing engineers with a method of locating and recording points in space with ease and efficiency.

Four Billion Cycles per Second

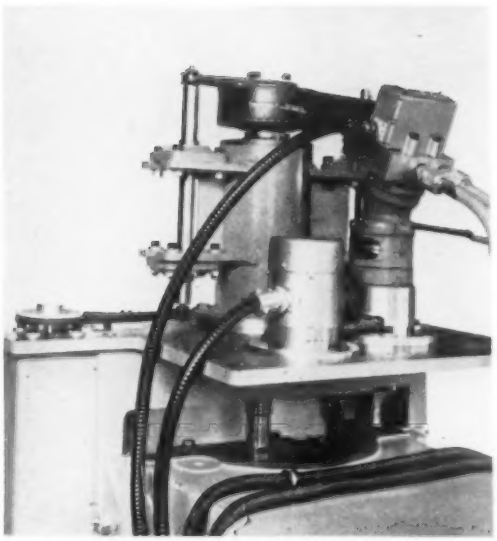
Scientists have successfully made tiny electronic devices called tunnel diodes that work at frequencies above 4000 megacycles. The tunnel diode is the latest member of a family of solid state electronic devices that includes the transistor and the solar cell. Like the transistor, the tunnel diode is a basic device in an electronic circuit but it has advantages the transistor does not. It achieves high frequency easily and is relatively insensitive to temperature changes and nuclear irradiation. It is expected that tunnel diodes will be used extensively in high-speed computers, communications equipment and nuclear controls as a companion to the transistor. More reliable, micropowered miniaturized electronic equipment such as computers, oscillators and amplifiers is expected to result from the development.

Credited with the development are Drs. R. N. Hall, N. Holonyak, Jr., and I. A. Lesk of General Electric. Key to the improved performance is the use of gallium arsenide as the basic element in the device's construction. Oscillation frequencies of 4400 megacycles have been obtained, indicating that frequencies well above 10,000 megacycles are possible with tunnel diodes made of gallium arsenide. Other advantageous characteristics of the device include high current ratios, high current densities, and wide voltage swings.

designed for

PRODUCTION

Machine Prevents Workhardening



VERTICAL LEADSCREW DRIVE with cover removed. Amplified electrical commands from magnetic tape are converted by Pulservo (front center) which actuates servo valve (upper right) controlling fluid flow.

Titanium and superalloys present difficulties in machining because of work-hardening in cutting areas. Caused by burnishing action of cutters as they stop or dwell, workhardened areas must be removed before machining can continue. Failure to remove them results in cutter damage and, in some cases, damaged parts.

In many instances numerical control is a practical and economical solution to problems resulting from the poor machinability of titanium and similar materials. Workhardening resulting from cutter dwell is eliminated by elimination of the dwell.

As an example of this, one company has reduced machining time on titanium engine mountings from four hours to 45 minutes—while eliminating scrap—by adapting a Micro-Path installation to a No. 5 Cincinnati vertical milling machine. In this installation, commands from magnetic tape actuate pulservos which control hydraulic servovalves. These meter the fluid flow to axial-drive motors in proportion to motion commands. Constituting a closed-loop system which insures exact motion response, this unit provides automatic operation while holding tolerance to within 0.003 inch.

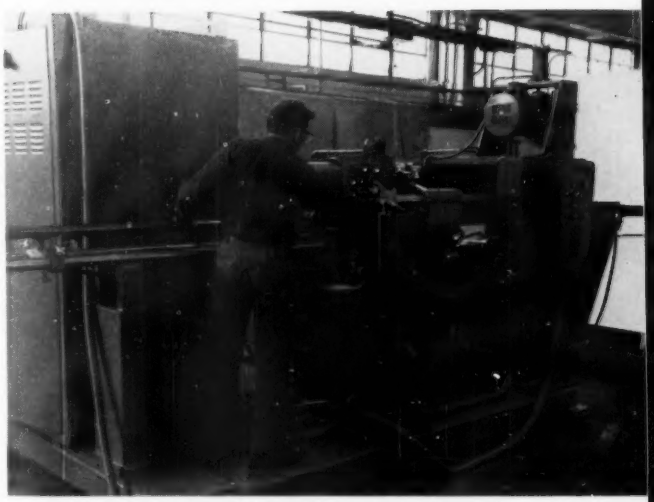
TITANIUM ENGINE MOUNTING. Workhardening was eliminated through use of numerical control.

Numerical Tape Controls Pipe Bender

Machine automatically bends lengths of straight pipe into automotive tailpipes with the aid of numerical control. Utilizing General Electric's point-to-point control system, the machine controls three motions—carriage feed, polar rotation and angular bending of the pipe. Auxiliary functions, all of which are programmed, include selection and positioning of dies, control of polar and head-stock clamps and actuation of a cutoff device.

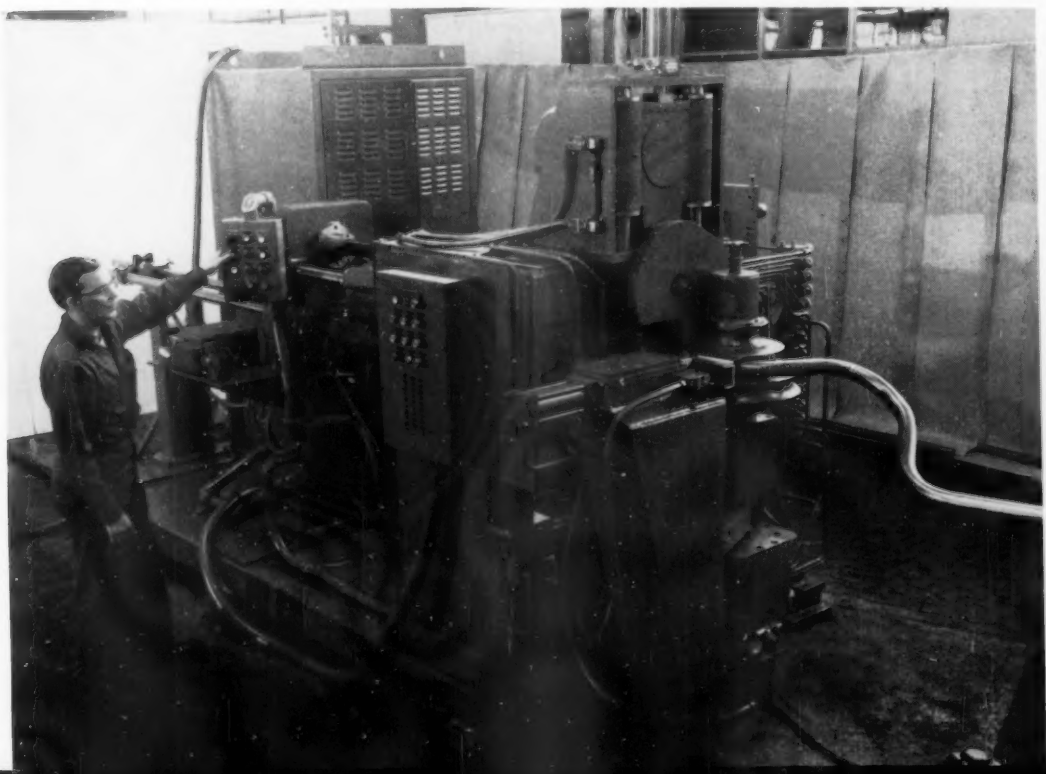
Machine cycle is initiated by loading a length of straight pipe into the feeding unit, which carries it to the forming dies. These forming dies bend the pipe to angles specified by the tape at the rate of six bends per minute. Ability of the machine to rotate the pipe through 360 degrees enables it to form angles in any plane. After the angles are formed, the pipe is cut off according to taped dimensions.

Principal advantage of this machine is that it economizes in warehouse storage space while being able to produce a greater selection of tailpipe models. Inasmuch as all tailpipe designs—from those of the early Twenties on—can be put on tape, large (and highly taxable) inventories of older models are no longer necessary.

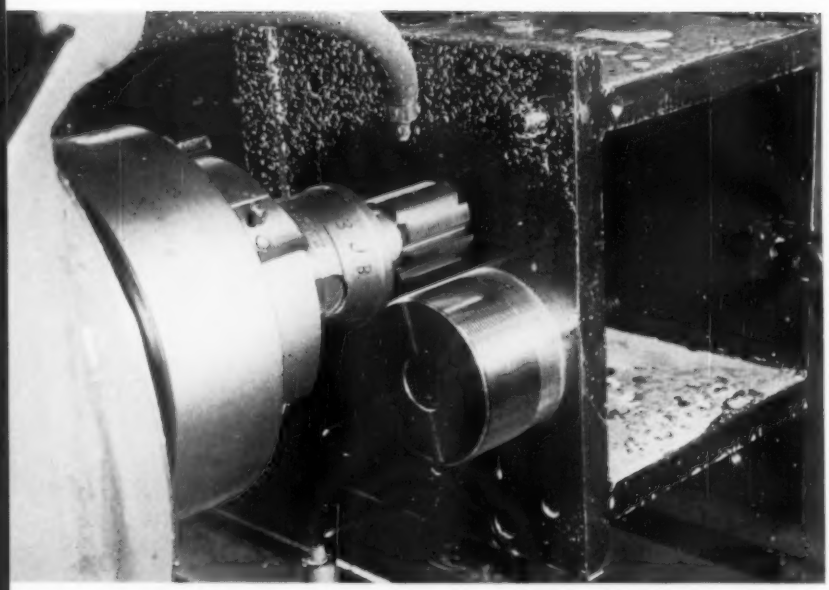


THE START of a machine cycle. All problems of "retooling" are solved by changing the tape.

BY ROTATING PIPE as it passes through the angle-forming dies, machine can produce infinite variety of twists.

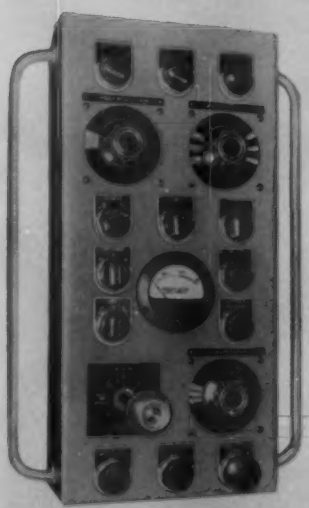


Tape Control Solves Threading Problem



Thread milling of studs and other components inaccessible to conventional threading devices can be performed by numerically controlled thread milling. In the example illustrated, a Numeric-Keller is machining a thread to a programmed tolerance of 0.0001 inch. It also demonstrates the possibility of machining—in a single automatic cycle—workpieces which normally require secondary machining operations.

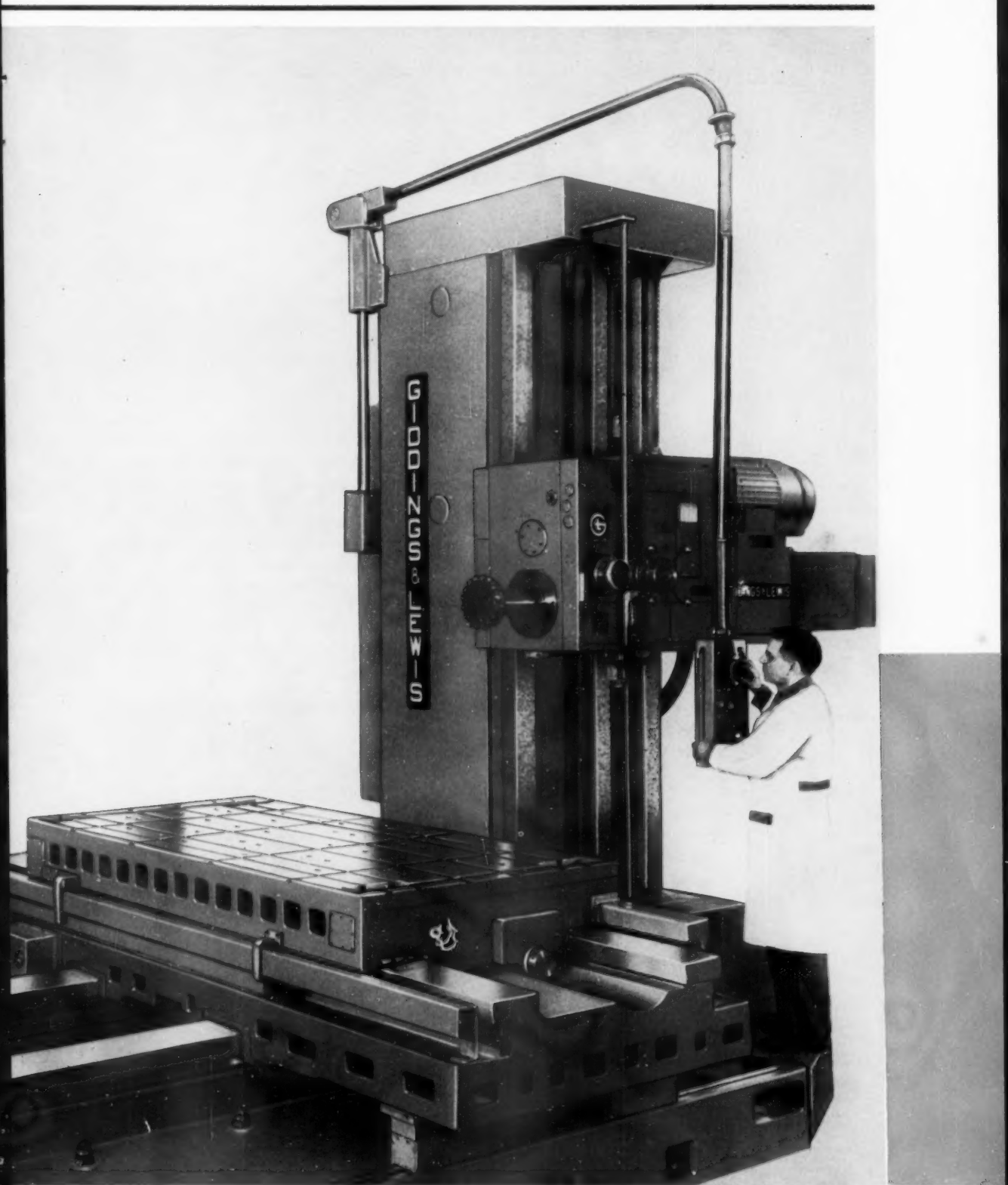
Joy Stick Simplifies Controls



Pendant control of all machine functions simplifies operation of this machine. Produced by Giddings & Lewis Machine Tool Co., the pendant also provides "joy stick" control of head and table movements. Moving the stick up or down moves the headstock up or down; right or left moves the table right or left. Movement of the stick at any of four 45-deg angles causes simultaneous movement of both table and headstock. Any of these independent or combined movements can be made at rapid traverse by pressing a button in the central knob.

In addition to controlling feeds, speeds and direction of movement, the pendant actuates electrohydraulic clamping mechanisms. These can lock the head, table, saddle and spindle individually or collectively.

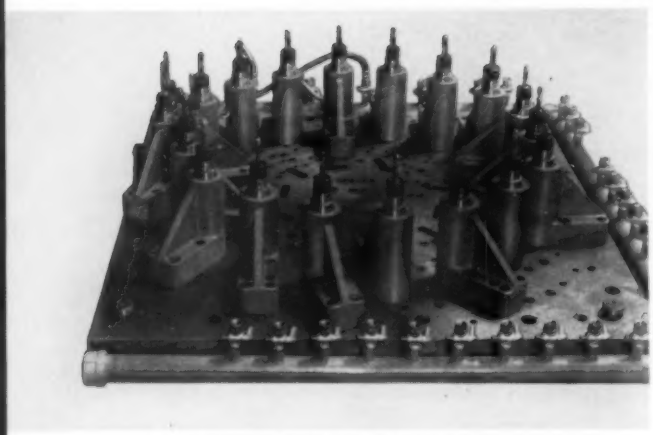
REMOTE CONTROL of machine is provided by this panel. Handles assist in moving unit to control direction of head and table motion.



PENDANT-CONTROLLED MILL. Additional design innovation is three-way column supporting headstock.

DESIGNED FOR PRODUCTION

Work Shuttles Between Turret Heads



WORK LOADED in shuttle fixture preparatory to machining, turret head at left performs four complete sets of machining operations. Head at right performs two.

AUTOMATIC except for loading and unloading, this machine is designed for drilling, tapping, boring, chamfering and spotfacing operations on 13 different sizes and styles of gas-meter bodies. Utilizing building-block construction to facilitate model change-over, the machine is equally efficient in machining either aluminum or cast-iron castings.

In operation, a workholding fixture shuttles to the first turret head where two drilling and two tapping operations are performed. Withdrawing and indexing, the fixture then shuttles to the other turret head where two other operations are performed. Indexing design of three machine units—two turrets and the workholding fixture—provides six discrete sets of machining operations within a single machine cycle.

Built by Michigan Special Machine Co., the machine has a work capacity equal to 97 drills and 67 taps. Output is 10 units per hour.

DRILLING PLATE with preset drill spindles. Units can be positioned to machine 12 other models.

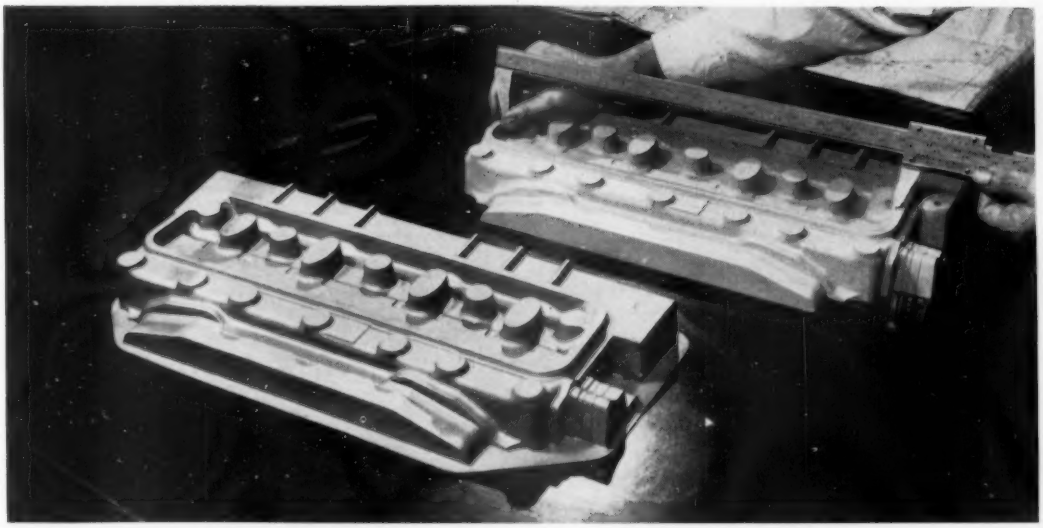


Fig. 1. Final inspection of pure-nickel cylinder-head pattern (left) against master. This pattern was produced without machining.

toolmaking without machining ... long-term research pays off

By T. W. Black, Senior Associate Editor

With a new gas-deposition process, forming dies and foundry patterns can be produced to close tolerances without machining. Lead time is greatly shortened. Dies and patterns fabricated by this process give excellent service.

PROGRESS IN TOOL ENGINEERING is dependent, to a large degree, on the successful development of new processes and methods. While some outstanding advances in manufacturing are the result of the efforts of individual tool engineers who conveive an idea and carry it to the point of production reality, modern industry relies, to a large extent, on planned research and development programs carried out by teams of specialists.

Many of these programs are necessarily of a long-range nature. New processes cannot be developed overnight and there is often a period of years between the time a research objective is established and the time it reaches the stage of practical—and profitable—application on the production floor. Many ideas that seem promising on paper lose that promise when they are subjected to the acid test of prolonged research, development and testing.

Nevertheless, if the risks are great, so are the rewards and an increasingly larger number of companies are investing their time, scientific and engineering talent—and dollars—in long-range manufacturing research and development programs. Experience has shown that it is these companies that have the best chance for success and survival in the intensely competitive world of modern industry.

An example is furnished by a program conducted by the Budd Co. to develop better methods of producing the forming dies used in its own operations. The program has already resulted in the development of a new tool material, carbonyl nickel, and a new toolmaking process, the carbonyl process, and it has had other significant results as well. The process is suited to making complex foundry patterns, core boxes, die-cast molds, permanent molds

and shell molds, as well as forming dies. Budd management is so confident in the ability of the process to compete with conventional toolmaking methods that it has established a new division, Carbonyl Metal Products, to manufacture tooling for the metal stamping and foundry industries. This division, which has its own well-equipped plant, is a direct and tangible result of Budd's bet on the ability of research to pay for itself.

The program began in September 1954 as a search for ways to produce metal tooling with the same ease that plastic tooling is produced. Electroforming and metal spraying, two possible methods for fabricating dies without machining, were thoroughly investigated.

The carbonyl process was also investigated at this time. Nickel carbonyl, $Ni(CO)_4$, which is a liquid at room temperature and a gas at 111 F, decomposes into free nickel and carbon monoxide at temperatures over 280 F. (Nickel carbonyl, the liquid or gas, should be distinguished from carbonyl nickel, the virtually pure nickel made by the carbonyl process.) Under carefully controlled conditions, the nickel can be deposited on the surfaces of a mold. Hence, Budd engineer reasoned, it should be possible to make a mold from a die model or master pattern, deposit nickel on the mold to a desired thickness, separate the resulting nickel shell from the mold and use the shell, which would be an exact duplicate of the original model or master, as a forming die or foundry pattern. No machining of contours would be required; toolmaking would consist of making the nickel shell and adding a plastic or metal backup.

Although the principles of making a die by the carbonyl process are easily understood, Budd engineers soon found that there were many obstacles to overcome before a production die could be made. Obviously, no one had practical experience with this method of die production. Although some research had been done on the deposition of nickel by the carbonyl process, much of this research was not applicable to the practical problems of tool-making.

Further, nickel carbonyl gas is highly toxic. (Carbonyl nickel, being pure nickel, is nontoxic.) When it is mixed with air, concentrations of more than one part in a billion are unsafe. In liquid form, nickel carbonyl is volatile, resembling ether. It burns with great speed, igniting spontaneously when it is mixed with air under favorable conditions.

Among the first problems to be solved, then, was the provision of means for safely storing, handling and controlling this toxic, volatile substance. Finding a suitable alloy for the mold was another problem. This alloy had to have the same coefficient of thermal expansion as nickel, could not affect the surfaces of the master die model or pattern in any way and had to be easily cast or applied. A research program was needed to develop the alloy.

Other specific problems were the design of the deposition chamber, the development of methods

Fig 2 (above). Formation of special eutectic mold on master of cylinder-head pattern. Liquid tin alloy is sprayed on master.

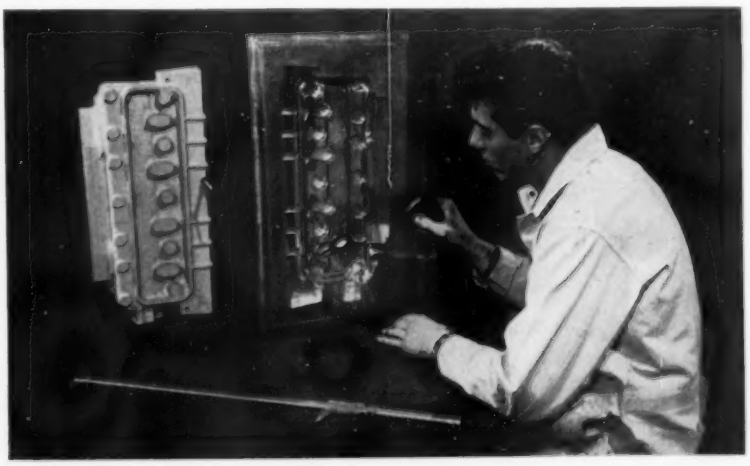


Fig. 3. Completed mold (right) is checked against master cylinder-head pattern before being placed in depositing chamber.

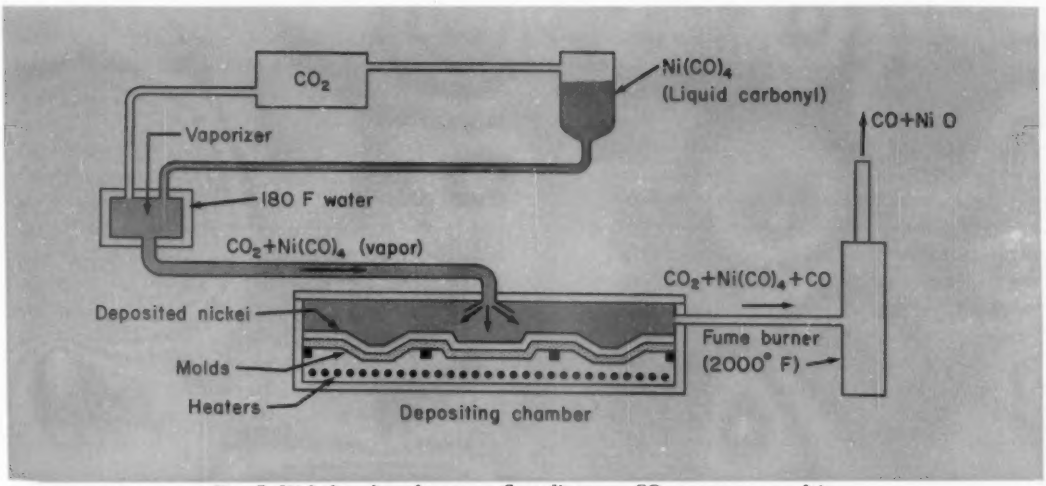


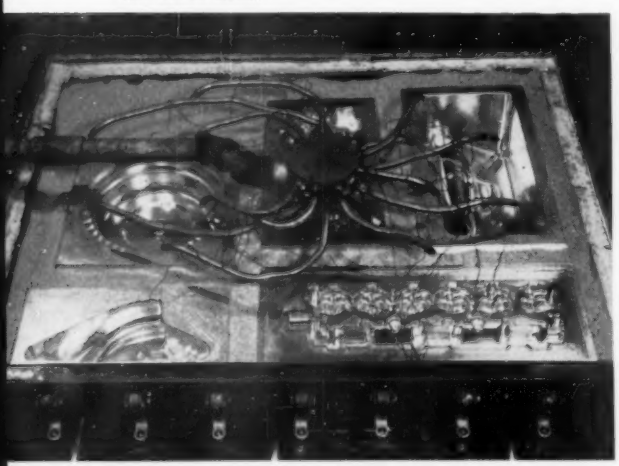
Fig. 5. Nickel carbonyl process flow diagram. CO_2 gas serves as driver, forcing liquid nickel carbonyl to flow into vaporizing chamber.

for introducing gas into the chamber, the selection of a means for heating the molds to the temperature at which deposition takes place and the accumulation of detailed data on rates of deposition, purity of the nickel, tool life and similar information.

These problems were solved and in early 1958 Budd made its first carbonyl-nickel product, a forming die. This gave excellent service in automotive production. A few months later, a pattern for a transmission extension bearing retainer was made, also for an automotive manufacturer, and was highly successful. In September 1959, a new plant for making carbonyl-nickel tooling was completed.

Today, with several years of experience in producing dies and foundry tooling, *Fig.* 1, with the new process, Budd engineers can make dies and patterns of any size from about 1 x 1 inch to 60 x 100 inches.

Fig. 4. Depositing chamber with molds, thermocouples and gas manifold in place, ready for sealing prior to entry of nickel carbonyl gas. Smooth surfaces of the molds will be duplicated in nickel. Molds are set in sand.



The first step in production is to make the mold. A release agent is first sprayed on the original model or master, which can be made of wood, plaster or metal. In the case of a foundry pattern, the master needs only the shrink required to make the ultimate product—the casting. No additional shrink is called for in the process. After application of the release agent, a molten eutectic compound (a tin alloy) is sprayed on the master. Layer after layer is applied to build up the mold. *Fig.* 2. This completed mold, which is a negative of the master, has a coefficient of expansion identical with that of nickel.

Next, the mold is removed carefully from the master, inspected for exact duplication and tolerances, *Fig.* 3, then placed with the impression surface upward in a depositing chamber, *Figs.* 4 and 5, where pure nickel is deposited to form a faithful replica of the original master.

Before the plating process can start, the mold must be heated to between 325 and 340 F. This is accomplished with resistance heaters located under the molds. Liquid nickel carbonyl is fed into a vaporizer by the pressure of compressed carbon dioxide, which does not enter into the chemical process but serves as a driver, eliminating the need for pumps in the system.

In the vaporizer, which is heated to 180 F by hot water, the liquid nickel carbonyl is converted into a gas. In the vapor stage, the nickel carbonyl expands several hundred times in volume and forces itself through the vaporizer lines to the depositing chamber.

Since the molds are heated, the nickel carbonyl

decomposes into free nickel and carbon dioxide. Nickel is deposited molecularly on the heated surface of the molds on a continuous basis, the thickness of the nickel shell being dependent entirely on time.

Approximately 0.150 inch of nickel can be deposited in 24 hours and a thickness suitable for most patterns can be built up in 24 to 38 hours. The rate of deposition is not affected by the shape of the mold. Dies and patterns with complex compound contours can be produced as easily as those having simpler shapes.

Release of carbon monoxide in the decomposition process creates a pressure within the chamber, which forces the gases through exhaust lines to a burner operating at about 2000 F. The gaseous nickel carbonyl is ignited and burned off and the carbon monoxide is converted to carbon dioxide.

The exhaust lines are charged with carbon dioxide, which acts as a snuffer and a shield against

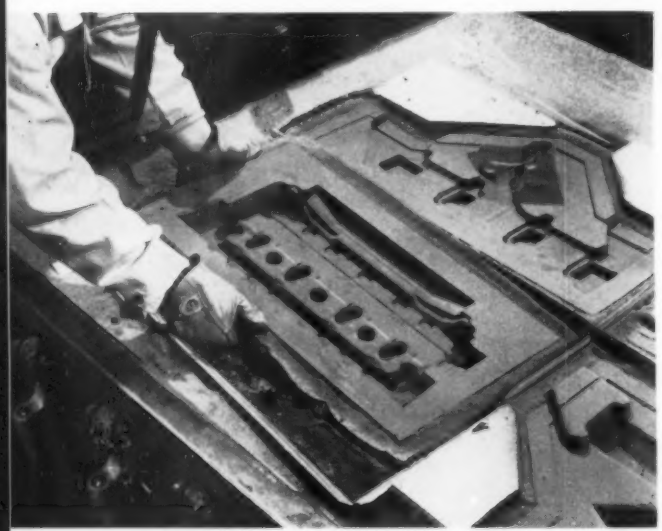


Fig. 6. Removal of complete nickel shell from vaporizing chamber. View shows back (nonreproducing) side of nickel shell. Front has smooth finish.

self-ignition of the nickel carbonyl within the depositing chamber. When the molds have received enough nickel, the nickel carbonyl input is stopped. The chamber is then purged with carbon dioxide, opened and the molds are removed, *Fig.* 6. The mold is then parted from the pure nickel shell. Molds cannot be re-used but the mold material can be melted and reclaimed.

For forming die applications, the nickel shell can be filled with a mixture of epoxy resin containing aluminum or iron fibers. A backing plate is added to give greater strength and also to provide a place for attaching lifting bolts and the like. This, then, completes the die or pattern.

An intermediate step is required when a negative, rather than a duplicate of the original master, is needed. An epoxy negative of the original model or master is made and this is coated with the eutectic compound to make the mold.

Carbonyl nickel has properties that make it an exceptionally useful and versatile tooling material. It is highly resistant to abrasion, having about four to five times the sand abrasion resistance of cast iron and being superior to aluminum, bronze and chrome-vanadium steel in this respect.

Also, carbonyl nickel has an extremely fine grain structure. Surfaces are smooth and tend to become polished with use. It does not adhere to other metals. In forming die applications, carbonyl nickel will not cold-weld to the sheet metal being worked, so there is no chance for scoring. In addition, no lubricants are needed in forming operations. Tensile strength is 85,000 to 90,000 psi, and elongation is 15 to 20 percent. (This ductility is desirable in many applications, but makes carbonyl nickel unsuitable for blanking, shearing, cutting or extrusion dies.) Hardness is 181-222 Bhn. Carbonyl nickel foundry patterns tend to work-harden under impact of sand from sand slingers, blowers and rammers. One pattern currently in use by an automotive manufacturer has made over 100,000 impressions without appreciable wear. A forming die for sheet-metal parts has so far made over 50,000 hits without detectable wear.

The material is easily welded, using acetylene or arc-welding techniques. It is also one of the easiest materials to braze or silver-solder and it takes lead-tin soldering well.

Because it is a transferring or molding technique, the Budd process accurately duplicates every detail of the original master. Reproducibility tolerances are well within the limits established by the foundry industry—from -0.005 to $+0.010$ inch over-all tolerance, with an average tolerance of ± 0.005 inch.

Some possible future applications are the fabrication of blow molds for thermoplastic materials (the nickel shell is easily water-cooled), molds for glass and rubber products, and die-casting molds for all-aluminum engine blocks. The high resistance of carbonyl nickel to thermal shock up to 1600F permits rapid quenching or cooling, which is not possible with cast irons or steels—a property of particular interest to tool designers.

Budd research, then, has paid off not only in the development of a new method for producing forming dies—the original objective of the program—but in a new and useful tooling material that can be shaped without machining, at costs that are highly competitive with other methods and with greatly shortened lead time. Planned, creative research programs of this kind are, in the long run, the keys to success in manufacturing.

how to determine OPTIMUM FEEDS AND SPEEDS

By Robert M. Akers*
Methods and Tooling Group Leader
Cabot Shops, Inc.
Pampa, Texas
and
Sidney S. Smith**
Industrial Consultant
Rath & Strong, Inc.
Boston, Mass

What combination of variables results in lowest cost machining? Cost factors can be plotted on charts to obtain fast answers without complex mathematics.

IN DETERMINING optimum cutting conditions all tool and manufacturing engineers deal with many and complex variables—cutting tool materials and geometries, toolholders, work holding devices, machining conditions, work materials and so forth. No universal procedure exists for determining which exact combination of all variables is the best. Minimum total machining cost occurs when both labor cost and tool cost are at a minimum. But these are opposed factors, for as the rate of metal removal is increased to reduce labor cost, tool life is decreased and tool cost increases. The objective is to find the shortest machining time consistent with reasonable tool life.

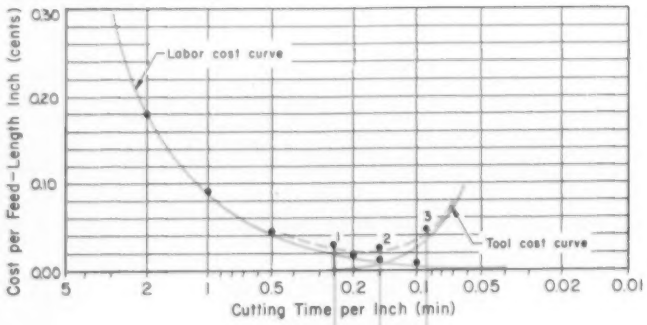
In the optimization method to be described, feed rate and speed can be varied and other conditions such as tools, depth of cut and so forth can be assumed. Tests are often necessary to check assumptions. Labor and tool costs are stated in terms of units of travel or feed for comparison. The unit of comparison is the "feed-length inch."

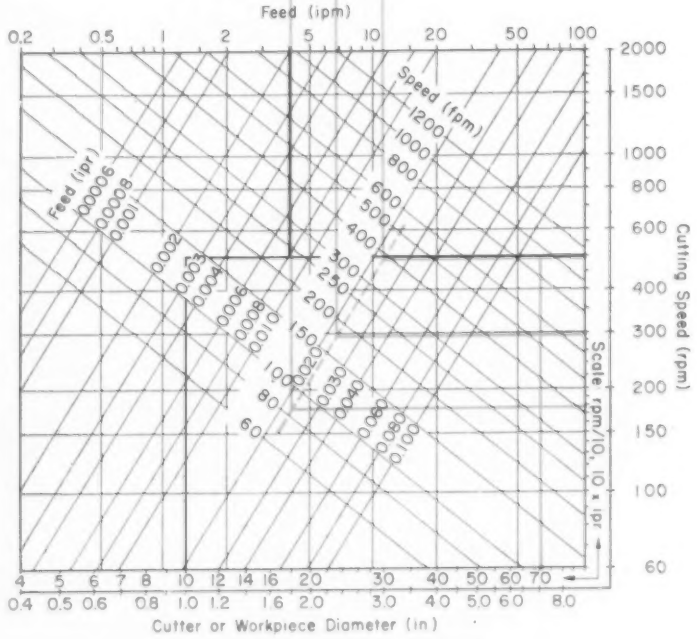
The method is not a substitute for experience, intuition, or intelligence. Rather, it is a means of organizing data and assumptions in an orderly fashion, on two forms. By using the forms, progress is efficient and sure in going from known facts and assumptions to the optimum set of machining conditions. The forms help to focus and sharpen tool engineering experience. The method is flexible enough to serve both for rough approximations and by testing, increasingly refined and accurate solutions. By comparing the effect of different variables on cost and recording them on the forms, a case file is gradually built up that serves as a quick and valuable reference for determining minimum cost on new jobs as they come in.

Method: Countless variables with many complex interrelationships confront the tool engineer trying to determine optimum cutting conditions. An educated "feel" provides a start. The final answer

*Senior member ASTME Tulsa chapter.
**ASTME Member-at-Large.

Computation Chart





	Diam	rpm	fpm	ipr	ipm	Min/in.
Example:	10	50	130	0.08	4	0.25
	1	500	130	0.008	4	0.25

Data Sheet

MACHINE GROUP TRACER ENGINE LATHE NAME AMERICAN NO. L-8

TYPE METAL SAE 4145 ANNEALED HARDNESS

MATERIAL VARIATIONS

TYPE CUT ROUGH TURN (PRE-HEAT TREAT

SIZE OR DEPTH OF CUT .375 DEPTH — 7" DIAM.

PART NAME D-32002 RT. PINION LOT SIZE 20

FEED LENGTH/PCS. 30 IN. REPLACE OR REGRIND INDEX INSERT EVERY 3RD PC. (90")

SPECIFICATIONS: TOLERANCE 1/32 SURFACE FINISH √500 MICRO IN.

TOOL — DRILL SINGLE PT. ✓ MULT. PT. TEETH

CUTTING MATERIAL GRADE 350 CARBIDE MFG. CARBOLOY

TIP TYPE AND SIZE TBT-204U4

BODY TYPE, SIZE, MFG. KENNAMETAL KTGR-20A (HVY. DUTY)

ANGLES: CHIP BREAKER, TYPE CBT-20-AS PURCHASED SIZE ✓

RAKE	RELIEF	CLRNCE.	E.C.E.A.	S.C.E.A.	RADIUS	POINT	CHISEL	WEB	
B AS	E PURCHASED	K							

GRIND NONE — INDEX 6 EDGES AND THROW-AWAY

SUGGESTED OPERATING CONDITIONS TYPE COOLANT SOLUBLE OIL

		1	2	3	4	5	6	7
FEED (IN./REV.)(IN./MIN.)		.0222	.0222	.0222				
SPEED	(R.P.M.)	180	300	500				
MIN. PER IN.	(CHART)	.25	.15	.08				
TOOL LIFE	(PCS.)	3	1½	⅓				
TOOL COST	($/IN.)	.005	.010	.044				

LIMITS — SAFETY, POWER, QUALITY, MACH. CONDITION: .0222 R.P.M., FEED 180

COMMENTS — CHIP, TYPE WEAR, CHATTER, RIGIDITY, ETC.

ADVISABLE TO INDEX TOOL ONLY AT COMPLETION OF A CUT OR PIECE

COMPUTATIONS: DEPARTMENT M.S. LABOR: $ 5.40 PER HR. $ .09 PER MIN.

$/CUTTING EDGE = $\frac{\text{ORIGINAL TOOL COST}}{\text{REGRINDS/TOOL}}$ + (TOOL CHANGE AND REGRIND COST) = $ .44

$/FEED LENGTH IN. = $\frac{\$/\text{CUTTING EDGE}}{(\text{TOOL LIFE IN PCS.})(\text{FEED L./PC.})}$ = $ $\frac{44}{3 \times 30}$ = .005

CONCLUSIONS: SFPM 330 SPEED 180 R.P.M., FEED .0222 TOTAL COST/IN. $ .0275

BEST OPERATION FOR PRACTICAL APPLICATION

METHODS ENGR. Akers FOREMAN OPERATOR DAY DATE 12/19/59

often comes only after the job has been run and adjustments made as required. The procedure thus is first to record the assumed optimum conditions on forms that are basically computational aids. Second, to check optimum condition assumptions, tests are made and test results plotted as tool and labor cost curves. This enables graphic solution of the two cost factors that vary inversely per unit of time.

The Computation Chart, *Fig.* 1, is actually several charts combined into one for convenience. The lower portion correlates workpiece or cutter diameter (bottom), speed in rpm (right), and speed in fpm (diagonal). Speed in rpm (right), feed in ipr (diagonal) and feed in ipm (top) are also shown on the chart. Diameter range is from 0.4 inch to over 80 inches, in two scales. The range of rpm, 6 to 2000, is similarly covered in two scales.

The upper portion of the chart is for plotting the two cost curves and making graphic solutions. Cost, in dollars per feed-length inch (left) is plotted against time, minutes per inch (bottom). Both major portions of the chart are printed to the same scale, so that data plotted in the bottom portion can be projected into the upper portion for solution. The two scales between the top and bottom charts (ipm and minutes per inch) are reciprocals, another built-in computational device to save time and paper work.

The Data Sheet, *Fig.* 1, is used jointly with the Computation Chart in working toward a solution. Up to seven tests can be listed on the two forms. The Data Sheet is arranged in sections to record pertinent information. The following points should be kept in mind as each section is filled out.

Section 1: Machines and tooling are assumed to be in excellent condition. This assumption should be tested on the actual machine that will be used to run the job as the machine itself often influences test results.

Section 2: Material should be clearly and completely specified, noting any variations that occur from piece to piece or lot to lot.

Section 3: The test is made for a single tool and for one type of cut at a time. Roughing cuts that remove maximum stock with little attention to finish and size are listed separately from finishing cuts that provide finish and dimensional requirements using a light depth of cut to load the tools.

Fig. 1. Opposite page—Computation Chart and Data Sheet used to determine minimum-cost machining of a pinion. Three tests were run.

Section 4: The workpiece is identified. Assumed or historical lot-size is indicated. If a 10-inch shaft requires two rough cuts, then 20 feed-length inches would be entered. The tool can be returned to the crib and reground after each lot is run or when wear land exceeds a specified amount. The choice depends on lot size, extent of cutting per piece, tool type, shop practice and is an assumption that will be tested to determine whether it is consistent with least cost.

Section 5: Specifications for an acceptable finished part that the test must satisfy are listed.

Section 6: This box contains the specifications for the suggested tool, tip material and angles for the particular test. The quality of these assumptions can be determined by tests with other tools after the limiting conditions for the first test have been determined.

Section 7: Information entered here is partly obtained from the Computation Chart, as will later be explained. Tool life is measured in terms of the average number of good pieces made before the tool is changed as defined in *Section* 4. Space is provided for entering the results of seven different tests.

Section 8: Any conditions that prevent feed or speed from being increased further are listed, as these might indicate that additional tests should be run using different tools.

Section 9: For computations that will be used on the chart, labor cost per minute and tool cost per feed-length inch are entered. The equations are self-explanatory. Insert type tools simplify calculations by eliminating regrinding, holder changing and resetting of cut.

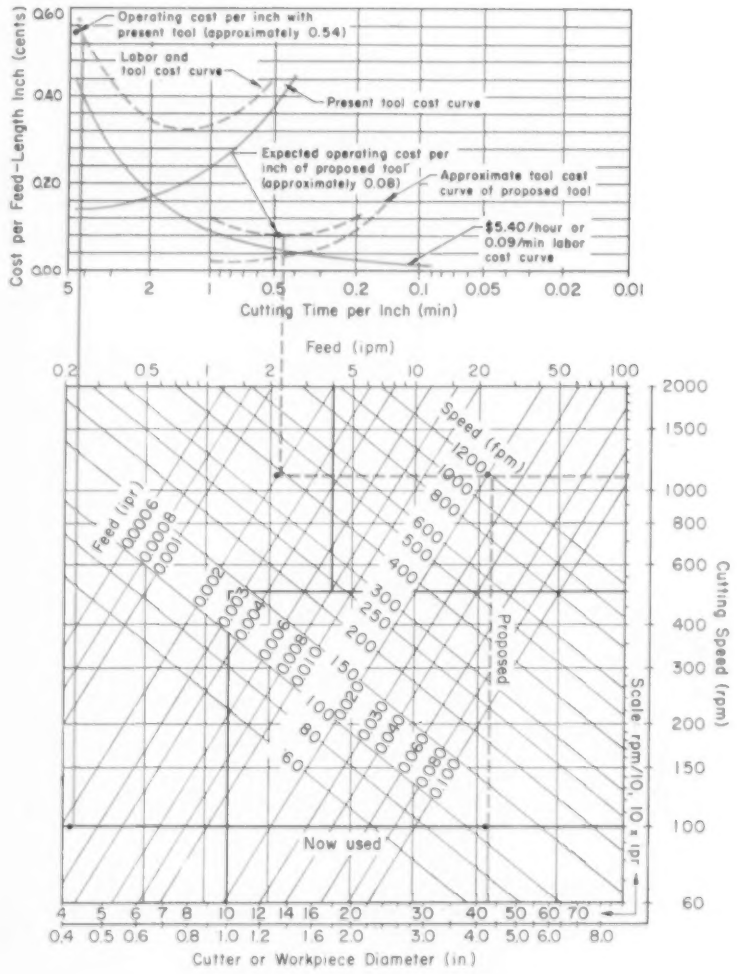
Section 10: Conclusions usually indicate that some assumption was not entirely accurate and is inconsistent with minimum total cost.

Examples: The method applied to the machining of a pinion is shown in *Fig.* 1. The first five sections of the Data Sheet were completed from available information. The best tool known for this type of cut was selected and *Section* 6 filled out. A feed of 0.0222 ipr was assumed and entered in *Section* 7. Speed of 330 fpm was assumed, but not entered as this factor is used on the Computation Chart. In *Section* 9, labor cost of 9 cents per minute was entered, and the cost per cutting edge computed based on assumptions and historical records.

At this point, the Computation Chart was used to record and develop more data. Through the diameter, seven inches, a vertical line was drawn till it intersected the diagonal speed line. For the first test, a speed of 330 fpm was assumed. At the intersection, a horizontal line was drawn rightward to compute speed in rpm. This speed, 180 rpm was entered in *Section* 7. The horizontal line was extended leftward to intersect the diagonal feed line, 0.0222 ipr. A vertical was constructed from this intersection upward into the graph. Speed in rpm and feed in ipm was thus computed. Tool cost is later marked on the vertical projecting into the graph.

For the second and third tests, greater speeds

Computation Chart



	Diam	rpm	fpm	ipr	ipm	Min/in.
Example:	10	50	130	0.08	4	0.25
	1	500	130	0.008	4	0.25

Data Sheet

MACHINE GROUP ENGINE LATHE NAME LODGE & SHIPLEY NO. L-3

TYPE METAL SAE 1050 HOT ROLLED HARDNESS

MATERIAL VARIATIONS SOFTER IN WELDED AREAS

TYPE CUT FINISH TURN (TO BE SATISFACTORY FOR BRAKE SURFACE)

SIZE OR DEPTH OF CUT .030 DEPTH — 42" DIAM.

PART NAME WIRE LINE SPOOLING DRUM LOT SIZE 10

FEED LENGTH/PCS. 11 IN. REGRIND EACH 11" OF TURN LENGTH

SPECIFICATIONS: TOLERANCE 1/16 SURFACE FINISH 125 MICRO IN.

TOOL – DRILL ____ SINGLE PT. ✓ MULT. PT. ____ TEETH ____

CUTTING MATERIAL REX 95 H.S.S. MFG. ____

TIP TYPE AND SIZE 5/8" SQ STD. TOOL BIT

BODY TYPE, SIZE, MFG. STD. ARMSTRONG HOLDER

ANGLES: CHIP BREAKER, TYPE ✓ SIZE ✓

RAKE	RELIEF	CLRNCE.	E.C.E.A.	S.C.E.A.	RADIUS	POINT	CHISEL	WEB	
B 20° S	E 5° S	E S			1/2				

GRIND ____

SUGGESTED OPERATING CONDITIONS TYPE COOLANT NONE ON MACHINE

	1	2	3	4	5	6	7
FEED (IN./REV.)(IN./MIN.)	.021						
SPEED (R.P.M.)	10						
MIN. PER IN. (CHART)	4.75						
TOOL LIFE (PCS.)	1						
TOOL COST ($/IN.)	.143						

LIMITS – SAFETY, POWER, QUALITY, MACH. CONDITION: ____ R.P.M., FEED ____

COMMENTS – CHIP, TYPE WEAR, CHATTER, RIGIDITY, ETC.

MAX. R.P.M. TO GIVE 11" OF TOOL LIFE. MOST DESIRABLE FINISH AT .021 FEED.
INVESTIGATE FOR BETTER CUTTING TOOL.

COMPUTATIONS: DEPARTMENT M.S. LABOR: $ 5.40 PER HR. $ .09 PER MIN.

$/CUTTING EDGE = (ORIGINAL TOOL COST / REGRINDS/TOOL) + (TOOL CHANGE AND REGRIND COST) = $ 1.58

$/FEED LENGTH IN. = ($/CUTTING EDGE) / (TOOL LIFE IN PCS.)(FEED L./PC.) = $ 1.58 / 1 X 11 = .143

CONCLUSIONS: SFPM 1200 SPEED 109 R.P.M., FEED .018 COST/IN. $ .028

CHANGE TOOL TO SQ 163 P3-WF-CERMET INSERT-KSBR-B5A HOLDER
SEE COMPUTATION CHART FOR COMPARISON

METHODS ENGR. Akers FOREMAN ____ OPERATOR ALLEN DATE 1/6/60

were assumed, plotted on the Computation Chart and entered in *Section* 7, columns 2 and 3, as was done for the first test. As a general rule, the second cutting test is selected to take 30 to 50 percent fewer minutes of machining time. A second vertical test line is then drawn downward where any one of many combinations of feed and speed can be chosen. The third test is usually chosen similiarly.

Actual testing was conducted under the conditions assumed for each test, running several tools at each value of feed and speed. Tool life in pieces was then entered in *Section* 7 of the Data Sheet and tool cost per inch computed using the equation of *Section* 9. After it was computed, tool cost per inch for each test was entered in *Section* 7 and plotted on the appropriate vertical extending into the graph. Connecting these points together formed the Tool Cost Curve. The Labor Cost Curve was constructed by marking several points in the graph and connecting them in a curve. Points were marked at 2 minutes (18 cents), 1 minute (9 cents) and so forth. The two curves were added graphically and their sum plotted as the dashed line. This is the Total Tool and Labor Cost Curve. Where it dips the lowest, minimum machining cost occurs. The dip is fairly broad and permits some latitude of operation. In this series of tests, it was found advisable to index the tool at the end of a cut or piece (Comments, *Section* 8) so that the first set of assumed conditions turned out to be the most practical.

Fig. 2. Opposite page—Use of the Computation Chart and Data Sheet readily demonstrates a potential savings by changing tooling.

As experience is gained in using this method, a single cutting test often serves to rough in the tool cost curve, so that the pair of forms can serve as an estimating device, as was done to improve a current job. The Computation Chart and Data Sheet are shown in *Fig.* 2. The job was being done at the maximum rpm that would give the 11 inches of tool life necessary to complete the cut. It was felt that this could be improved upon using a throwaway insert. Based on previous experience with this type of insert, a tool cost curve was approximately roughed in, using feeds and speeds also based on experience. As can be seen, a cost improvement of almost 700 percent is expected. Additional testing would provide more accurate information for a still lower cost per feed-length inch. A larger run of spooling drums would justify more testing.

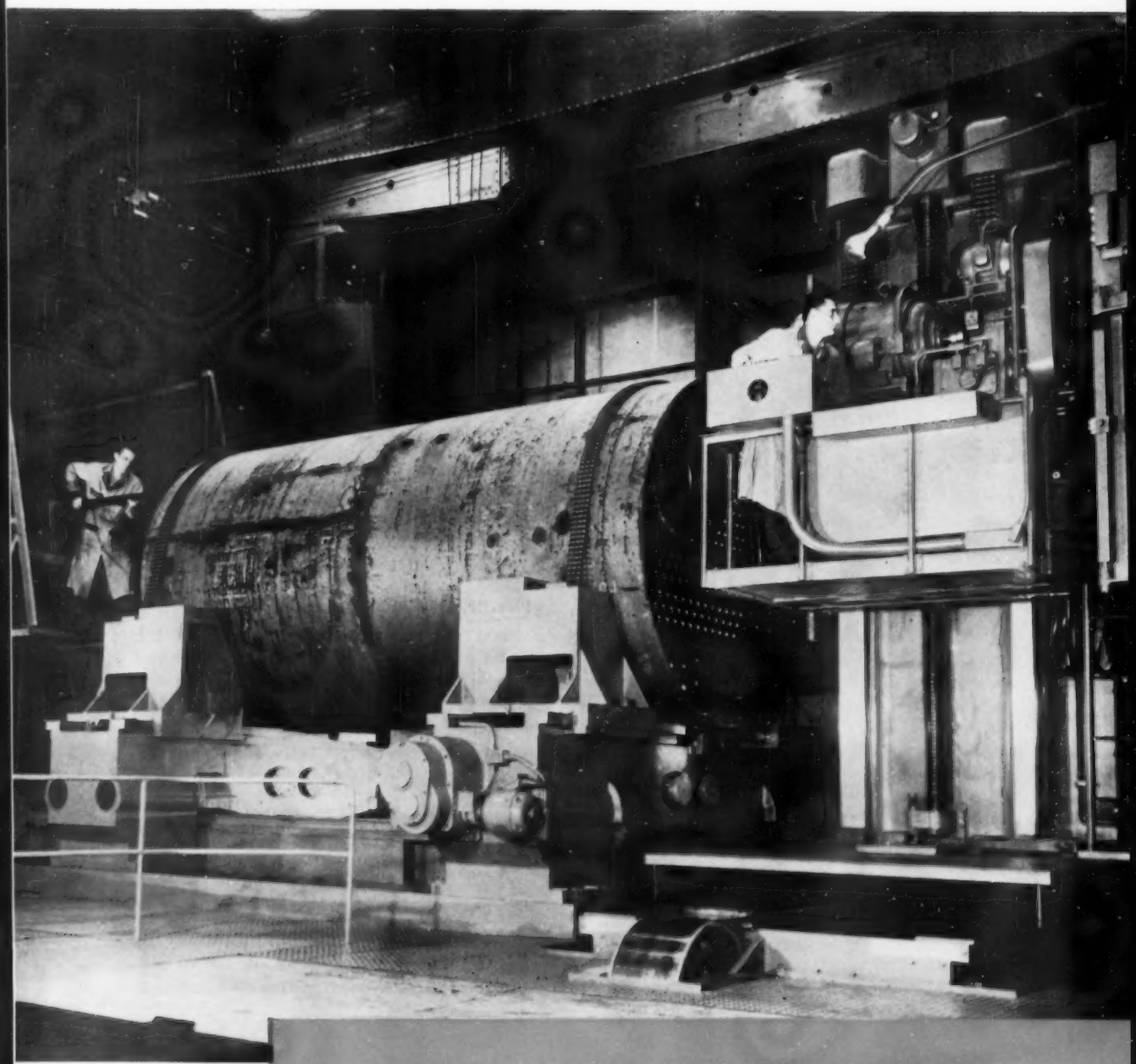
To improve the state of the art, to approach optimum machining conditions more closely, the method uses assumptions based on experience and provides a means of testing the assumptions and of improving on them. The method is flexible and is useful both for rough estimating and for close determination of costs. As a file of completed forms is built up, cost information becomes available for determining optimum machining on future jobs.

Machining Cost Halved

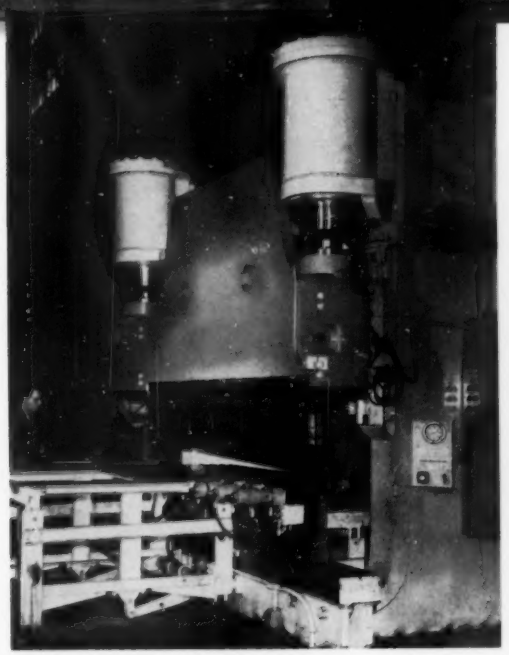
Tripling the metal-removal rate on a 12-inch diameter cut resulted in increased production, but tool engineers responsible for the work felt that further improvement was still possible. The machining operation being optimized was rough turning a 12-inch-diameter, 6 inches long on the end of an SAE 4130 forged steel bar on a 20-hp engine lathe. It was originally run at 400 fpm using a 0.125-inch depth of cut and a 0.015-inch feed. Cutting edges lasted 4 hours. When speed was increased to 1196 fpm, keeping the feed and depth of cut unchanged, cutting edge life was reduced to 30 minutes.

Decreasing the tool life increased the cutting edge costs to about $0.15 per hour. But this was a less important factor in total machining cost than a lathe operating cost of $6.50 per hour. Total machining cost per piece had been reduced by the increase in pieces machined. However, the frequency of indexing the carbide inserts had been increased to once every 30 minutes from once every 4 hours and was not entirely satisfactory. Tool engineers at this west coast manufacturer of rocket and missile components felt that an improvement was desirable.

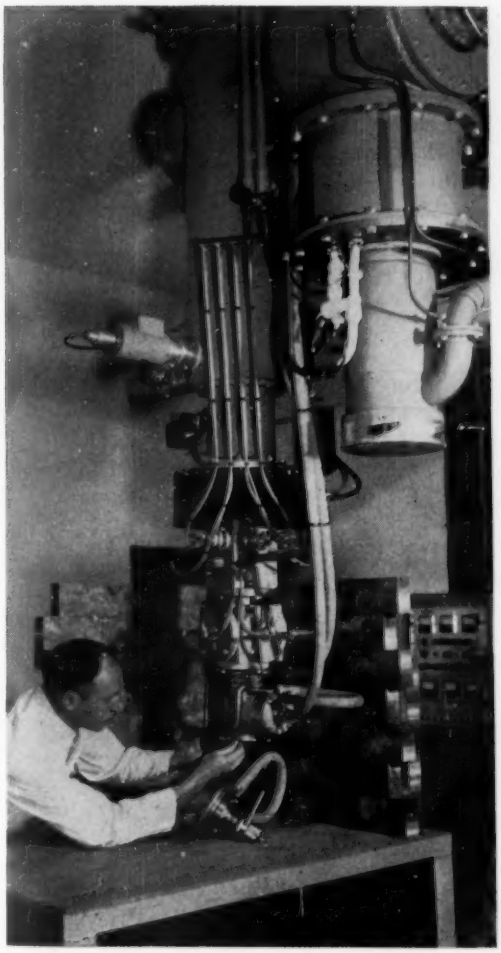
There was a possibility that tool life be lengthened by a change in the grade of the carbide in the throwaway inserts. Tool engineers investigated and after several cutting tests, the hardest steel-cutting grade made by Kennametal, K7H was tried. Edge life returned to the original four hours, thus reducing the frequency of indexing. Further, tool cost became the same as for the original operation. Floor-to-floor time was reduced to six minutes, half the time required before tripling the speed. Consequently, machining cost per piece was cut in half—from $1.74 to $0.87. Insistence in seeking optimum machining conditions resulted in doubled shift production together with reduced machining costs.



PHOTOELECTRICALLY CONTROLLED boilermaker machine automatically lays out, trepans and chamfers holes in boiler flue sheets at Cleaver-Brooks Co. After a flue is inserted into position, the machine flares the ends and beads them into position. Four electric eyes scan a master chart of black dots representing flue holes on a white background. The eyes, responding to the light variations on the templates control movement of the machine housing, head and spindle. The machine was made by Ingersoll Milling Machine Co.

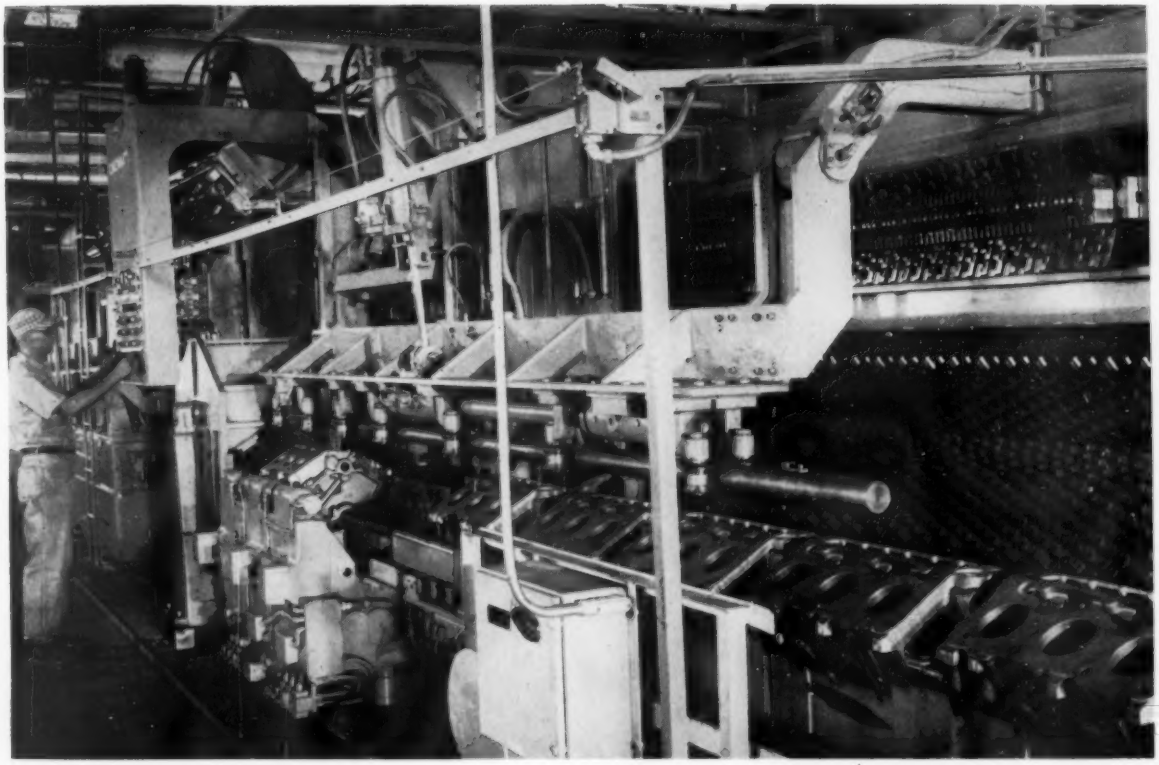


MULTIPLE-FLUTED TANKS are formed on a press brake from 6 and 10-ft pieces of steel plate $\frac{3}{16}$ and $\frac{5}{16}$-inch thick. Formed tanks are used in the construction of transformers at Allis-Chalmers Mfg. Co. Fluted construction makes transformer maintenance easier.

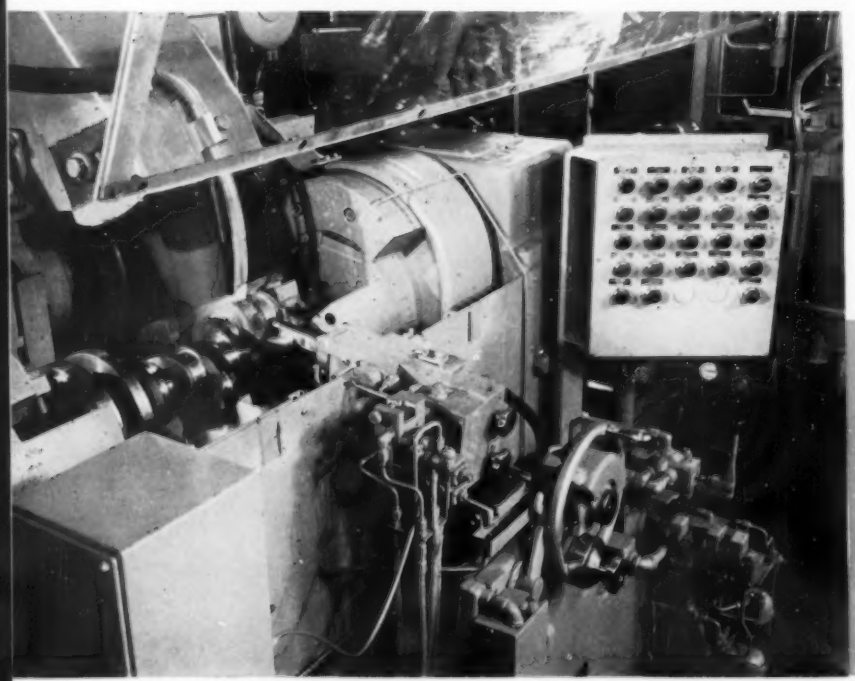


HIGH-VOLTAGE ELECTRON GENERATOR is used to study effects of electron beams and gamma-rays on diamonds at Diamond Research Laboratory in Johannesburg. The accelerator propels electrons at velocities up to 130,000 miles per sec. It is operated by remote control and its activity checked by a closed-circuit television system.

TOOLS at work



BROACHING REPLACES MILLING of cylinder blocks at GMC Truck and Coach Div. Top and bottom surfaces are broached on the first station. At the second station, the bottom bearing cap surfaces and half-rounds in the block are broached. Machine accommodates both six and twelve-cylinder blocks.

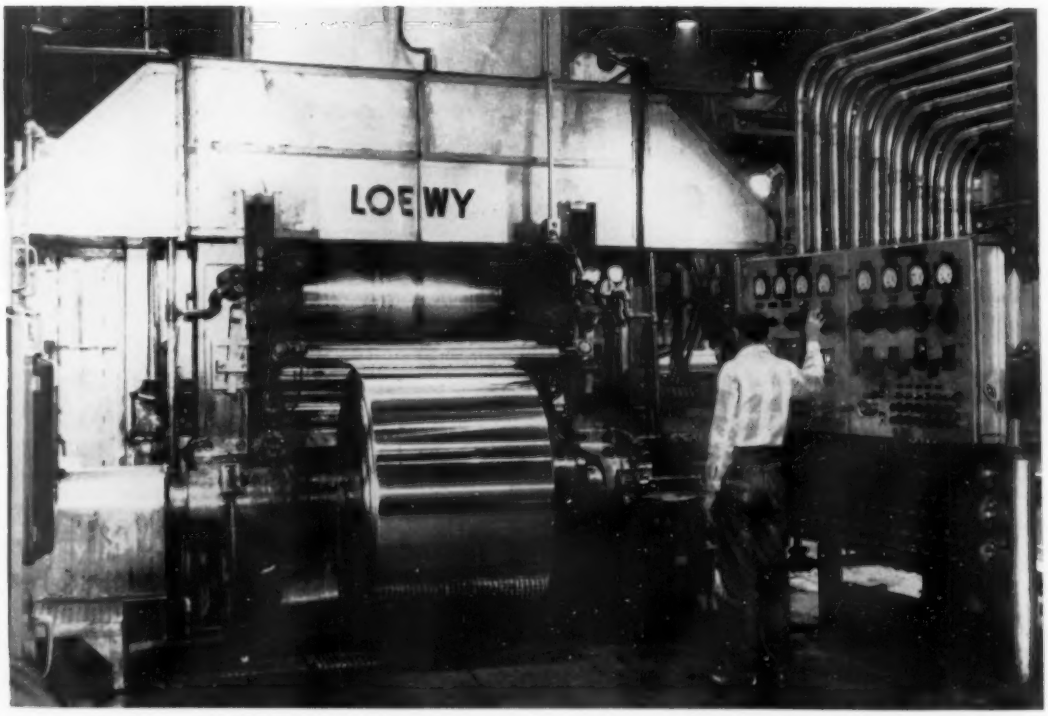


CRANKSHAFT GRINDER finishes fillets on bearing surfaces of engine crankshafts at GMC Truck and Coach Div. Machine, part of a progressive line, automatically dresses wheel after each grind.

ALUMINUM HAND FORGING is worked between flat dies on an 8000-ton hydraulic forging press at Alcoa's Cleveland works. The 8230-lb forging serves as a core or mandrel for an electroformed coating of nickel.

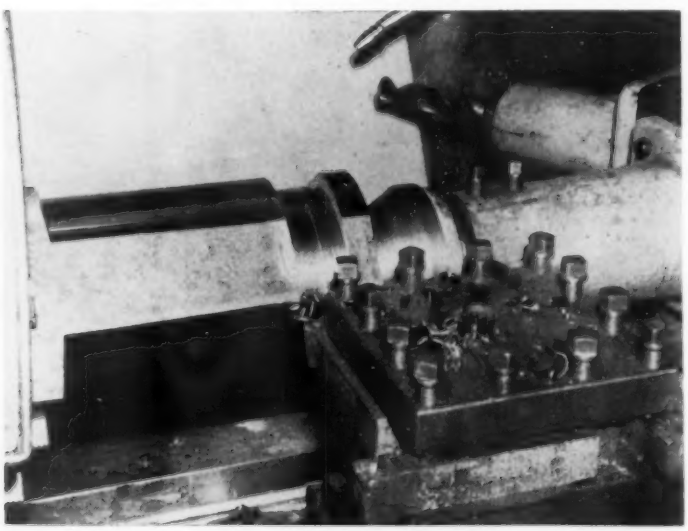
ALUMINUM MANDREL is finish machined at Douglas Aircraft Co. Following machining, a 5/8-inch coating of nickel is applied to the mandrel by electro forming. The assembly is then exposed to sub-zero temperature to separate the coating from the aluminum mandrel. The nickel shell is used for a test chamber air jet nozzle.

TOOLS at work



AUTOMATIC GAGE CONTROL developed by the Westinghouse Electric Corp. is used to regulate the thickness of aluminum foil being rolled on a four-high nonreversible cold-reduction foil mill operated by the Kaiser Aluminum and Chemical Corp. An X-ray gage measures the thickness of the foil as it is rolled and feeds a signal to the control when the foil thickness deviates from the desired thickness setting. The control varies the speed of the rolls and thereby the coefficient of friction between the foil and the rolls as well as the strip tension to maintain uniform delivery thickness. The system can control the accuracy of 0.0007-inch double-foil aluminum to within 1½ percent of the total thickness.

TOOLS at work



ROUGH TURNING OPERATIONS are performed on a 8¼-inch square billet with carbide insert tools at Marvel Schebler Products Div. of Borg-Warner Corp. Cut is taken at 240 rpm across corners of the billet. The cut to the 8½-inch collar diameter is made at a maximum of 690 fpm with a feed of 0.019 ipr and ⅝-inch depth of cut. Grade K21 square Kendex inserts are used on a Gisholt 4L turret lathe.

Automatic Operation simplifies cable manufacture

By Edward H. Ostendorf
Assistant Chief Processor, Electronics
Methods Engineering Div.
The Emerson Electric Mfg. Co.
East St. Louis, Ill.

Relatively simple changes made it possible to automate wire marking, stripping, and cutting operations, with a consequent 50 to 75 percent increase in efficiency. This is an example of how production bottlenecks can be broken by creative tool engineering.

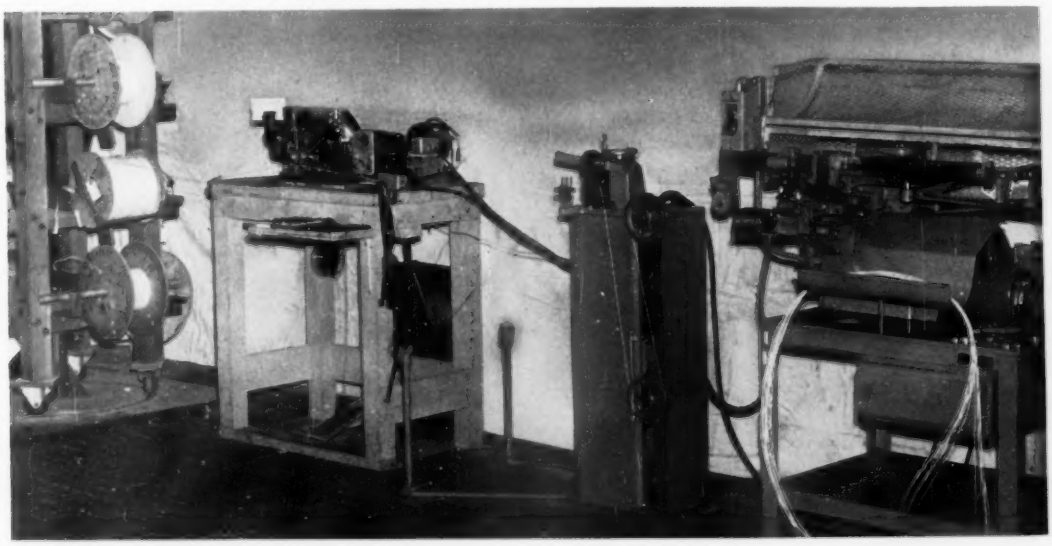
PREPARATION OF THE WIRE used in electrical and electronic assemblies can be costly when manual handling is employed. Costs of wire preparation can often be sharply reduced if manual operations are replaced with automatic handling. Ingenuity, rather than elaborate tooling, can make this possible.

Operations on wires for a cable assembly are a case in point. Originally, the wires were de-reeled, cut and stripped by one operator, then moved to a different area and marked by another operator. Handling represented a major portion of the cost of these operations and, since the wire strands were bent or twisted during handling, an added operation was required to return them to the proper configuration before dip-tinning the stripped ends.

Efficiency was improved from 50 to 75 percent by combining the cutting, marking and stripping operations, which now are controlled by one operator. In the new system, a wire is fed from a reel to a marking machine, then through an idler, de-reeler and automatic cutter-stripper. The entire wire travel is in a straight line, *Fig.* 1.

Up to 16 reels of wire of various gages and types are held by a rack at the start of the system. The rack is a four-sided wood structure, mounted on casters. It rests on a steel plate and can be revolved 360 degrees about a steel center post to bring a desired reel into position. All reels are mounted on

Fig. 1. Setup for automatic marking, stripping and cutoff of wire. Wire from one of reels at left passes through marking machine, idler, de-reeler and cutter-stripper machine (right). One operator handles the entire system.



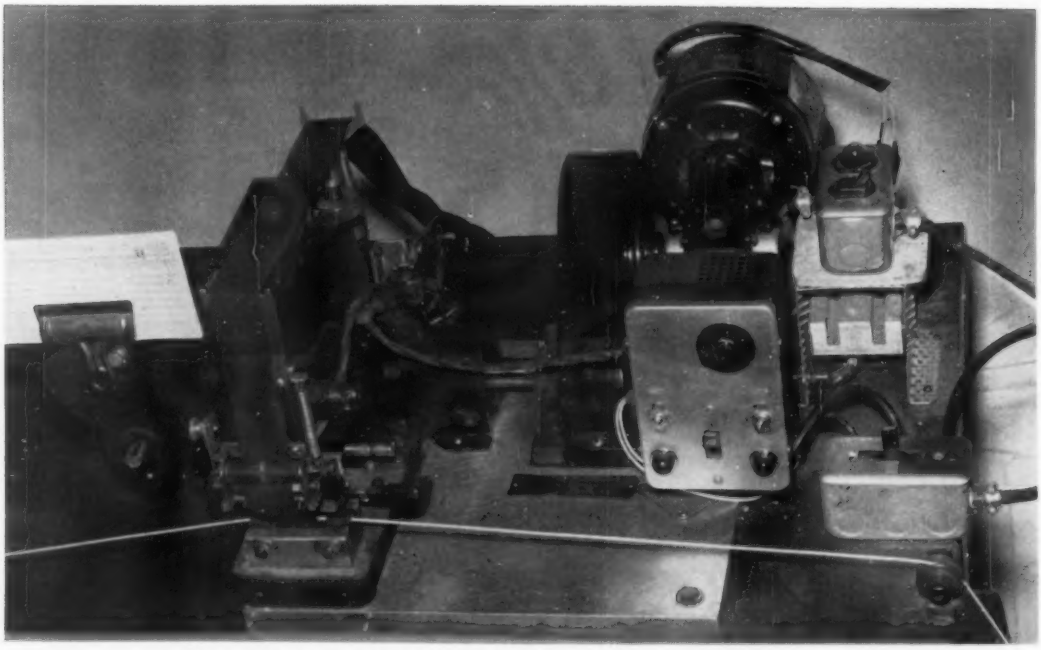


Fig. 2. Marking machine stamps code identification numbers on wire.

bronze bushings to reduce de-reeling friction and to eliminate wobble.

A motor-driven de-reeler, synchronized with the cutter-stripper feed speed, pulls wire from the reel through the marker and idler. The marker is a standard Kingsley machine, somewhat modified, *Fig.* 2. To permit the operator to make all adjustments from one side of the machine, the marker is operated with the wire travelling from left to right, opposite to the direction intended by the machine designer. The type holder stop was moved to the right side of the type head to make this possible.

Rates of wire travel in this system are determined by the cutter-stripper. Specifications dictate the spacing of identification codes; therefore the spacing is controlled by the marking rate, which must be variable. Using the existing motor of the marking machine, and equipping it with a V-belt and step pulleys, eliminated the need for purchasing a variable-speed drive motor. The marking machine was mounted on a new base plate so that the motor could be relocated. A safety guard covers the belt and pulleys.

Another addition to the marking machine is a red light that shows when the heating element is operating. Type sets are preheated so that while one group of wires is being run, the type set for the next operation is being raised to marking temperature. This eliminates delays between runs.

An idler wheel between the marking machine and the de-reeler dampens jerks created by the stamping operation. The de-reeler also has an idler, which dampens the irregular speed caused by the feed mechanism of the Artos cutter-stripper machine.

The only modification of the Artos machine was a wiring change to make it the master control. A counter on the machine is preset to the quantity of pieces desired. When this figure is reached, the entire system is stopped by a contactor that is part of the counter. A three-way switch allows manual operation of the marker, automatic operation of the entire system or separate operation of the cutter, as required.

The number of setups required is reduced by preplanning. Wires for various cable assemblies are grouped in alphabetical-numerical order by common gage and type. Only two adjustments are made when changing to the next wire within any one group: the length is changed on the cutter and the correct preheated type set is placed in the stamping head.

Since the development of this system, over two million pieces of wire, ranging in length from one to fifteen feet, have been run. Production experience has shown that the system is highly efficient and very little maintenance has been required.

Our Apologies to . . .

Dr. Heinrich Heimann, author of the article: "Analysis of Cutting Force—A Work-Energy Approach" in the March 1960 issue of THE TOOL ENGINEER. The editors regret that Dr. Heimann's name was misspelled on the contents page and on the first page of his fine article.

Tool Life of Single-Point Tools

By C. A. Hadley
Senior Process Engineer • Harley-Davidson Motor Co. • Milwaukee, Wis.

RELATING FACTORS OF TOOL LIFE, cutting speed, and feed in the proper combination reduces costs of machining operations and allows more advantageous use of machine tool capabilities. In general, the combinations of these factors which prove to be most useful in terms of economical operation are established as a result of experimentation and experience. The nomograph on the following page represents a summary of such data in a compact form. It can be used to determine feed, speed or tool life pertaining to a single-point-tool machining operation. The values obtained through use of the nomograph will give results suitable for most conditions based on good practice. Under unusual conditions of machining, modifications may have to be made to suit the particular application.

Use of the Nomograph

To determine feed or speed with a preset tool life, first establish point *a* on Scale A as shown on key, from appropriate values of tool material, *t*, and workpiece material, *m*. Next, determine a point, *b*, on Scale B from depth of cut, *d*, and tool life, *l*. Connect points *a* and *b* intersecting Scale C at *c*. Point *c* connected with feed, *f*, on Scale 6 will give a resulting cutting speed, *s*, on Scale 1. When connected with a given cutting speed value, point *c* will give the desired feed on Scale 6.

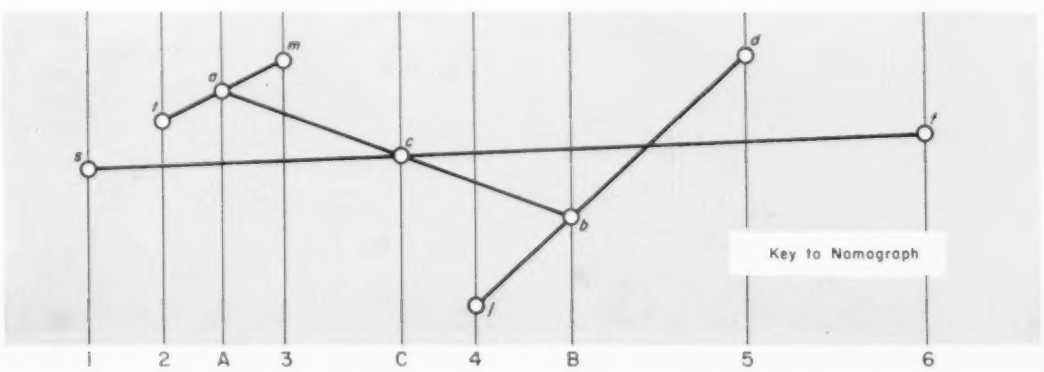
To determine tool life, point *a* is established from *t* and *m* as before. Point *c* is established from values of *f* and *s*. Point *b* is found by connecting *a* and *c*. Determine tool life on Scale 4 by connecting *b* and *d*.

References

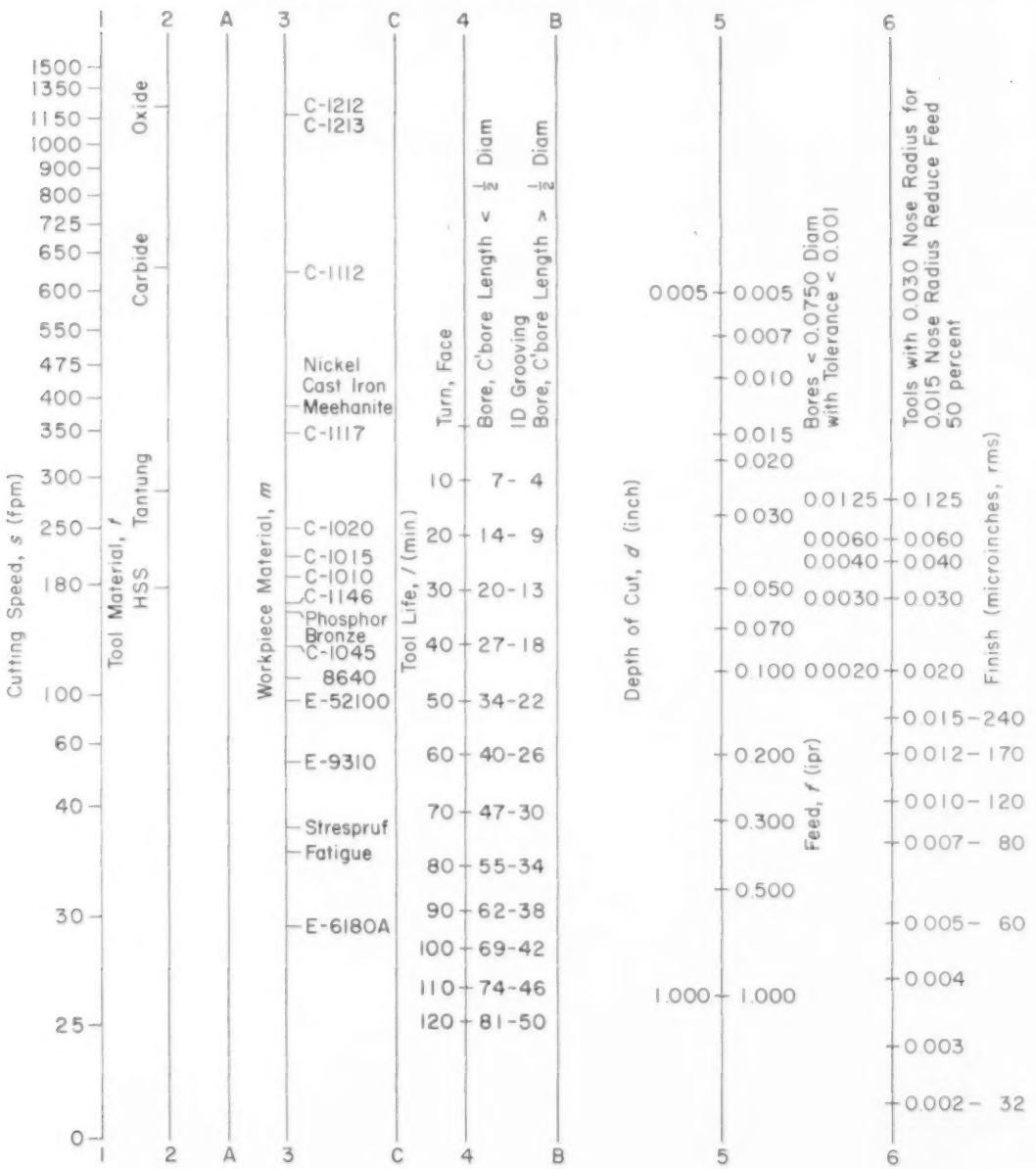
1. Le Grand, Rupert—"*American Machinist's Handbook*," McGraw-Hill Book Co., Inc., 1955.
2. Wilson, Frank—"*Tool Engineers Handbook*," McGraw-Hill Book Co., Inc., 1959.
3. "*Better Turning Results*"—Monarch Machine Tool Co.

Notes: **The Nomograph is based on the use of coolants. For operations where coolant is not used, multiply values on Feed Scale by 0.8.**

For grooving tools under 0.100 inch wide, multiply values on Depth of Cut Scale by 2 and values on Feed Scale by 10.



Nomograph for Determining Tool Life of Single-Point Tools



ASTME news

Dale Long

President, 1960-61

American Society of Tool and Manufacturing Engineers

New Officers and Directors Chosen at Detroit

A MAN WHO RADIATES SINCERITY has become the 29th president of the American Society of Tool and Manufacturing Engineers. He is H. (for Harold) Dale Long, who was installed at the Annual Banquet and National Membership Meeting held April 27 at Detroit's Statler Hilton Hotel.

Others who took the oath of office from outgoing President Wayne Ewing were William Moreland, David A. Schrom, Philip R. Marsilius and Frank F. Ford, as vice presidents; H. Verne Loeppert as treasurer; and Francis J. Sehn as secretary. New faces in the officer hierarchy are Ford and Sehn, both of whom served last year as directors.

The Board of Directors elects national officers. The House of Delegates elects the directors.

At 49, Long has had a distinguished career as an industrialist and dedicated Society leader. Despite his duties as president and chairman of the board at Scully-Jones & Co. in Chicago and as a workhorse in the farflung operations of the ASTME, Long has managed to spend enough time at home to distinguish himself there, too, as a father. He has six daughters and five sons.

Firm Believer in Teamwork

As the size of his family would indicate, Long believes in "teams." His emphasis in his acceptance speech—which Ewing predicted would be a Long one—was on teamwork as the key to the continued progress of the ASTME and the larger society of which it is a part.

When asked to describe what the presidency of the Society meant to him, Long remarked:

"It is an honor to head such a dynamic organization and to associate with the leaders in the manufacturing industry playing the chief roles in revolutionizing the manufacture of material things for mankind. It is a challenge to maintain the rate of progress established by those who have preceded me. And it is an opportunity to serve the Society and all those who seek development and improvement by advancing the knowledge and practice of manufacturing technology."

Long has served the Society on the national level as first, second, third, and fourth vice president, as assistant secretary-treasurer, and as treasurer. He is also a past chairman of the National Finance Committee. In his earlier days with ASTME, Long headed several of the Chicago chapter's committees, and in 1951 he chairmanned the chapter itself. As cohost chairman he helped organize the 1952 Tool Show and Exposition in Chicago. He is a national director, just as he has been for the last five years.

Since 1940, when he began his career at Scully-Jones, he has been employed in all of the com-

ASTME's 1960-61 national officers posed shortly before their installation April 27. Left to right, they are H. Dale Long, president; William Moreland, David A. Schrom, Philip R. Marsilius and Frank F. Ford, vice presidents; H. Verne Loeppert, treasurer; and Francis J. Sehn, secretary.

Duane Brighton **Albert Underwood, Jr.**
New directors will take office in fall.

pany's manufacturing departments, and during World War II took charge of subcontracting for the firm. In 1942 he was made a vice president; in 1946, executive vice president; in 1951, president; and in 1958, chairman of the board.

A business administration graduate of the University of Illinois, Long has served as an adviser for the Chicago area of the National Management Association for several years. He was once chosen "Management Man of the Year" by NMA. A member of the planning council for the research and development division of the American Management Association, Long has organized a number of seminars for that group, including those on "Creativity in Research and Development," "Managing and Measuring Engineering Performance" and "Developing New Idea Sources."

Among his civic duties the new president of ASTME holds an honorary membership on the board of governors of his local hospital—this, after ten years of work on the board raising funds to build and equip the hospital. Long is currently clerk of the Session of the First Presbyterian Church in his community. He includes among his hobbies his family (quite naturally) and photography.

In telling what he hopes to accomplish during his year as the head of ASTME, Long said:

"I hope to lead the officers, the board and the staff forward toward the effective attainment of our Society objective which, as I interpret it, is to advance the knowledge and the practice of manufacturing technology and know-how. I hope to lead our Society to the accomplishment of this objective by dramatizing to the heads of manufacturing companies, to educators, to organized groups representing the manufacturing industry, and to other thought leaders, the key role that tool and manufacturing engineers play in the material progress and advancement of society."

Atlantan, Detroiter New Officers

The new vice president among the 1960-61 national officers is a member and past chairman of Atlanta chapter. Ford, also a national director, is a partner of Ford-Lynch Associates. A metallurgy graduate of Yale University, Ford has served as an associate professor at Georgia Tech and was a delegate to the World Metallurgical Congress in 1952 and 1957. He is a member of ASM and many other engineering, technical and civic organizations. He joined ASTME in 1948.

Dale Long and his wife Collette pose with their eleven children.

Francis J. Sehn, a professional engineer from Detroit, is the new national secretary. He was a director during the 1959-60 term. A member of the faculty of Wayne State University, Sehn is the owner of the Fran Sehn Co., a consulting engineering firm, and is president of Press Automation Systems, Inc. He is a member of the Society of Automotive Engineers and the Engineering Society of Detroit. He has served on ASTME's National Standards Committee and for six years as chairman of the National Technical Publications Committee.

Three Directors New on Board

The House of Delegates, whose votes voice the opinions of the 166 chapters of ASTME, met in closed session at Detroit April 25 and chose 14 men to sit for one year on the National Board of Directors. The directors-elect will take office at the semi-annual meeting in Los Angeles next November.

The fifteenth member of the 1960-61 board, as designated by the Society's constitution, will be Immediate Past President Ewing, of Los Angeles.

Besides Ewing, the line-up includes:

H. Dale Long, chairman of the board.

G. Ben Berlien, Oakland, Calif.

Duane Brighton, Peoria, Ill. Brighton, who served this last year as chairman of the National Finance Committee, is one of the new board members. He is machine tool supervisor at Caterpillar Tractor Co. He has held many Society offices at the chapter level (Peoria) and was one of the organizers of the Illinois Council.

I. H. Buck, Dallas, Tex.

Frank F. Ford, Atlanta, Ga.

Philip R. Marsilius, Bridgeport, Conn.

William Moreland, Ashland, Ohio.

W. J. Pender, Pawtucket, R. I.

Joseph L. Petz, Poughkeepsie, N.Y.

Dean F. Saurenman, Houston, Tex.

David A. Schrom, York, Pa.

Leslie C. Seager, Salt Lake City, Utah.

Charles M. Smillie, Detroit. Smillie is new on the board for the coming year but served this past year as the national treasurer. He is president of the C. M. Smillie Co. of Ferndale, Mich., and has held many offices at the Society chapter and national levels, including chairmanship of the Detroit chapter.

Albert Underwood, Jr., Windsor, Ont. The third new member of the incoming board is immediate past chairman of Windsor chapter. He is acting manufacturing manager of Ford Motor Co.'s Windsor operations. Nominated to the director slate by petition, Underwood will replace Bruce Fairgrieve of Toronto as the Canadian representative on the board. Fairgrieve is retiring voluntarily from the ASTME board.

ASTME Scholarships Go to 20

Winners of the 1960 ASTME International Education Awards were announced at a meeting of the National Education Committee in Detroit on April 22. The 20 winners, from colleges, universities, junior colleges and technical schools will receive a total of $11,000 in scholarships.

Recipients of the awards were chosen on the basis of their scholastic achievements and their financial needs. Student winners attending colleges and universities will receive $700 scholarships. Those studying at junior colleges and technical schools fall into the $400 category. All winners are either pursuing courses related to tool and manufacturing engineering now, or they intend to once they reach a higher college level. They have been thoroughly screened by both their own instructors and the National Education Committee.

Winners of the $700 education awards are:

Richard James Brocket—California Polytechnic College

William Eugene Brown—Ohio State University

Martin Chris Burgasser, Jr.—University of Cincinnati

George W. Coe, Jr.—University of Kansas

Marvin Frank DeVries—University of Michigan

Robert Charles Goad—Utah State University

Goetz Eberhard Pfaefflin—McGill University

Klaus J. Weinman—University of Illinois

Horace Clayson Lambert—University of Houston

Edward Otto Moeck—Queen's University

Winners of the $400 education awards are:

Gerry Lyle Albertson—Mohawk Valley Technical Institute

Louis Israel Cantor—Conn. State Technical Institute

James Melvin Dodd, Jr.—Southern Technical Institute

Henry Gentili—Western Ontario Institute

Robert N. Kahn—State University Agriculture and Technical Institute, Farmingdale, N.Y.

George Townsend Luhrs, Jr.—State University Agriculture and Technical Institute, Farmingdale, N.Y.

Angelo Cosmo Pallaria—State University Agriculture and Technical Institute, Canton, N.Y.

James Carol Rhoades—Southern Technical Institute

Ronald Alton Stott—Erie County Technical Institute

Thomas William Thompson—Wentworth Institute

Visitors received two kinds of welcome at ASTME's Engineering Conference and Exhibit in Detroit April 21-28. Signs all over the city, such as the big one above that blinks to traffic on the John Lodge Expressway, expressed the majority sentiment—"Welcome Tool Engineers." Signs carried by pickets, however, greeted visitors at the entrance to the Detroit Artillery Armory, site of the exhibition.

Tool Show

DESPITE RAIN on the first day and pickets every day, registration at the Detroit Tool Show April 21-28 set an official all-time record of 39,337. The door count, according to Show Manager Leonard Abrams, clicked well past the 100,000 mark.

Held in the seven-acre indoor drill area of the Detroit Artillery Armory, the show amassed 570 exhibits of machinery and equipment worth $15 million. The prodigious display of 6000 products—more than 900 of them shown for the first time anywhere—was dedicated to the theme of "Tooling for Productivity" in the new decade ahead.

The show returned to the birthplace city of ASTME after an absence of 19 years. Since 1941, Detroit had been bypassed because of a lack of exhibit facilities. The 1960 show, originally scheduled to be held at the huge $54 million Cobo Hall, was shunted to the Armory when completion of Cobo Hall was delayed. Future shows are scheduled in 1962 and other even-number years at Cobo Hall; in odd-number years the show will go to other key cities, with New York the host in 1961.

The Detroit show was the outstanding feature

Draws 39,337 at Detroit

of an eight-day program of 17 plant tours, 33 technical sessions, and numerous other ASTME activities grouped under the official label, 28th Annual Engineering Conference and Exhibit.

Key engineers and industry decision-makers from every state in the union and from at least nine foreign countries searched the 22 long aisles at the Armory for ideas. Two thousand tons of equipment, much of it in actual operation, offered everything from abrasive cutting machines to portable power wrenches—from nuts (10 exhibits) to bolts (eight exhibits). Automatization and numerical control prevailed.

Dr. Abe Silverstein, director of the Office of Space Flight Development, National Aeronautics and Space Administration, spoke at the kickoff Michigan Day Luncheon attended by Society, civic and industrial leaders. Silverstein called for confidence to keynote not only the ASTME's conference, but the attitude of all Americans toward the space race.

Describing negativism as the inhibitor of progress and confidence as the elixir of leadership, the space expert declared unequivocally that "we're the world leader in technology now." He cited ASTME as a vital link in a long chain of partners that will assure America's keeping that leadership.

Some indications of the show's magnitude:

An airline posted a departure record from the city on the last day of the show, with 1700 people—most of them Tool Show visitors—enplaning on the company's ships.

Nearly 400 phones were installed at the show.

Over 8000 feet of hose delivered compressed air to 200 users in the exhibit area.

Sixty lift trucks and 200 men working night and day for 48 hours brought in the crated equipment for the show.

A million watts were used for lighting; 2500 hp for operating machinery.

Some 5500 hotel and motel rooms were crammed with show visitors for the entire eight days.

Executive Secretary Harry E. Conrad, in hailing the success of the show and conference, said representation from distant states was higher than in any previous exhibition. Canadian neighbors accounted for an exceptional percentage of attendance.

Statement on Detroit Disorder by Executive Secretary

HARRY E. CONRAD, executive secretary of ASTME, has issued the following statement clarifying the Society's position in the labor controversy that attended the Tool Show.

"It is unfortunate that a jurisdictional dispute between two unions over which should uncrate the equipment at the Society's $15 million exhibit has marred ASTME's otherwise triumphant return to the city of its birth.

"It is especially unfortunate the Tool Show visitors were in some cases subjected to embarrassments and involvement in a cause in which they were innocent bystanders. It is deplorable that our exhibitors were exposed, through no inclination of their own, to a situation which led to unsavory headlines of 'extortion' and 'shakedown.'

"The dispute was like a domestic quarrel that disturbs the peace of a whole neighborhood. The innocent victims were the 570 exhibitors and the nearly 40,000 visiting engineers and manufacturing people who rallied to our show's theme of 'Tooling for Productivity.' Another victim was the good name of the community of Detroit, which managed to make us most welcome despite the noise of a misguided minority.

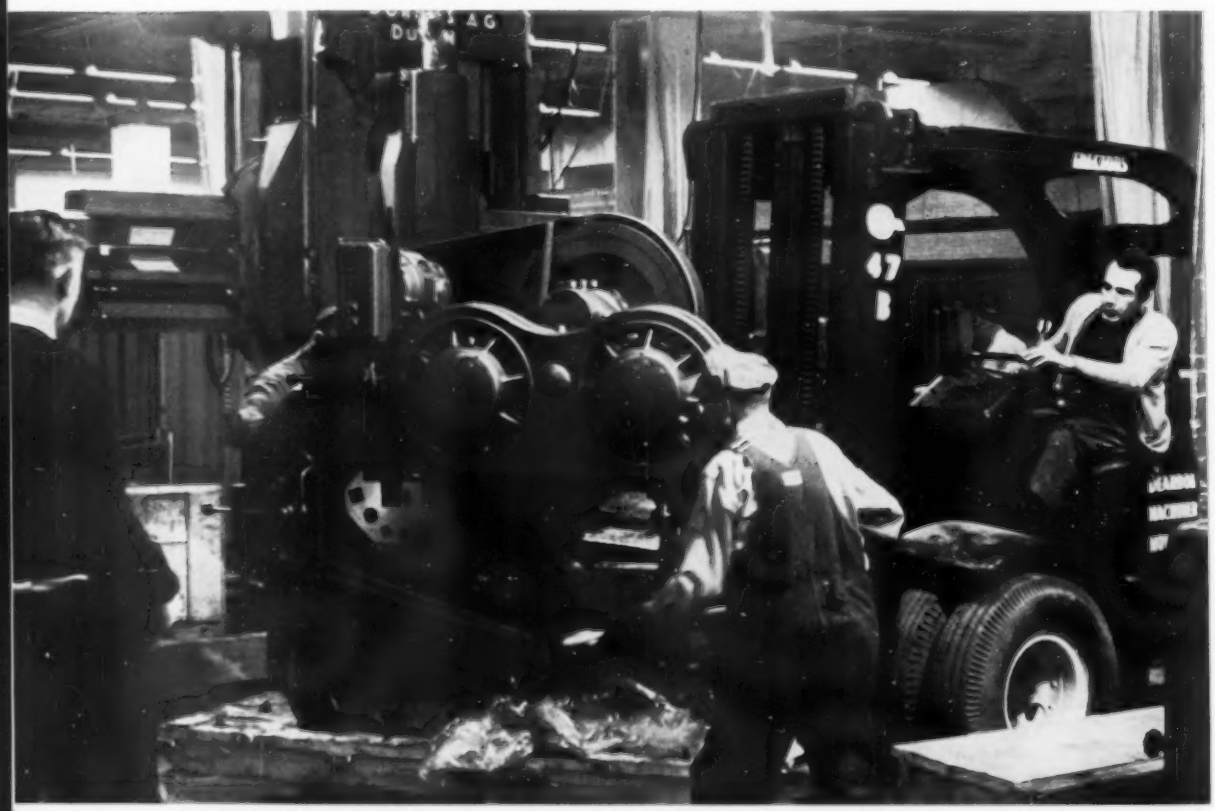
"In the over-all picture, in the light of what the Society set out to accomplish with its great exhibition, the effect of the Detroit disorder was insignificant. The attendance was the highest on record, the enthusiasm was immeasurable, the benefits obtained for industry and for society as a whole are incalculable.

"Our people came to Detroit to advance our civilization, rather than to barricade it."

TOOL SHOW

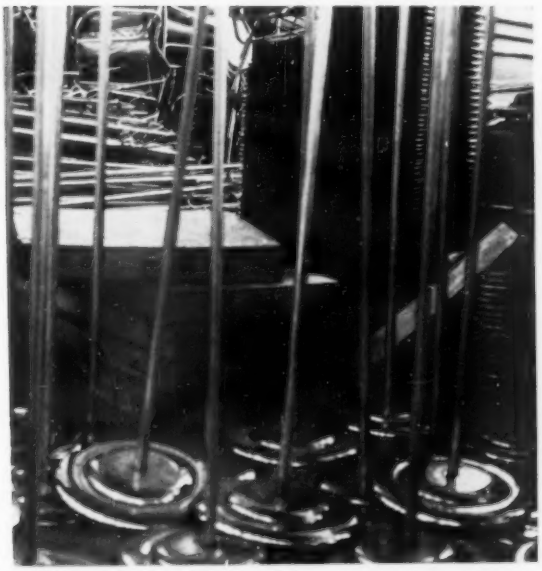
MOVING IN the myriad pieces that fit into the giant jigsaw that is an ASTME Tool Show called for finesse as well as fatiguing work. Here a workman signals gingerly to a crane operator.

"DON'T DROP," says one of hundreds of crates that contained the ingredients of some 570 exhibition booths at the Detroit show, which drew both exhibitors and attendees in record breaking numbers.

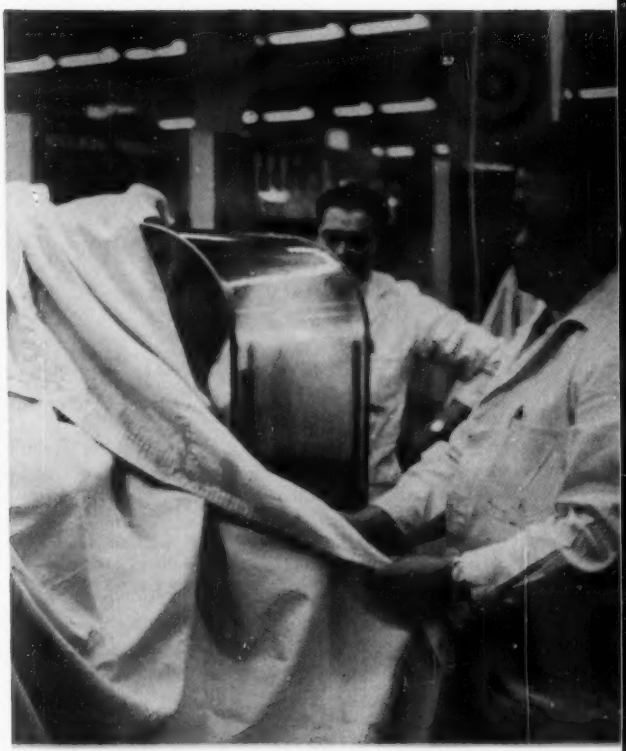


SETTING UP the machinery and equipment in the seven-acre exhibit space was a day-and-night job.

IN PICTURES!



HARDWARE of the Tool Show included hundreds of hat trees and chairs. A score of contractors supplied everything from compressed air to floral displays for the show's exhibitors.



"WRAPS OFF" was the signal for the week-long exhibition to open its doors. Here Chief Engineer Edward Harter uncovers a machine in the Wickman Products Co. booth.

HERE THEY COME, part of the 39,337 who crowded the "Rapid Registration" counters for badges.

FREE—TAKE ONE was the admonition from nearly every booth, and visitors left the show loaded with literature and gadgets. Here the Tishken Products exhibit rolls out free model train track.

WATCHING a tapping demonstration, these engineers remained oblivious to the precariously perched photographer above them.

KICKOFF Michigan Day Luncheon featured Dr. Abe Silverstein, director of the federal Office of Space Flight Development, who sounded a keynote word—confidence—for the Society's industrial exhibition, for industry and for the nation in general. "Confidence is the elixir of leadership," he declared, decrying the negativism of those who ask how much ahead of us is Russia in the space race. "We're the world leader in technology now, and ASTME is a vital link in the long chain of partners who will keep it so."

ONE SEGMENT of the "1200" aisle offers a panorama of organized commotion and color at the Tool Show. This was one of 22 aisles, plus every available corner of the Detroit Artillery Armory, that featured the 570 exhibits.

ALL QUIET prevailed once again in the Artillery Armory after the exhibitors moved out, leaving only the painted booth markers on the floor as an indication of their late presence. Show took eight days to set up, six days to clear out.

Long Briefs Committee Chairmen, Old and New

"TO ADVANCE THE KNOWLEDGE and practice of manufacturing know-how"—likening this, the Society's ultimate goal, to the hub of a wheel, ASTME President H. Dale Long pointed out to the 14 national committee chairmen chosen at the 28th Annual Meeting that their groups comprised the spokes of the wheel and that they were responsible for making this goal a reality.

Before the wheel can begin to turn, the committees must establish definite objectives, Long said. After discussion among the committee members, if it is discovered these objectives will not eventually lead to the advancement of know-how, they should be thrown out.

Long, in his briefing of the new and reappointed committee chairmen, offered some tips on what a good objective should possess. The objective should be written down, he said. It should be understood. It should be measurable and, finally, it should be current.

In accordance with a suggestion by the officers and directors, the national committees are now being headed by new chairmen. This revamping is part of a long-range program to bring fresh, new talent to the fore. All of the new chairmen have been working on their respective committees in recent years, so they are armed with sufficient background to use their authority confidently.

The chairmen, both new and old, chosen to head the national committees for 1960-61 are:

Constitution and Bylaws—Melvin G. Burdett, purchasing manager, Caterpillar Tractor, Peoria, Ill.

Editorial—John C. Hatter, staff engineer, Grumman Aircraft & Engineering Co., Bethpage, N. Y.

Education—Oliver S. Hulley, education consultant, General Electric Co., New York, N. Y.

Exposition—Arthur Mackmann, chairman and general manager, Franke Gear Works, Chicago, Ill.

Finance—Carl A. Darger, owner, C. A. Darger & Associates, Muncie, Ind.

Honor Awards—Ray H. Morris, president, Ray H. Morris & Co., Inc., West Hartford, Conn.

Judicial—T. Bert Carpenter, president, Bert Carpenter Co., Birmingham, Mich.

Membership—Robert M. Johnson, methods supervisor, Minneapolis Honeywell Regulator Co., Minneapolis, Minn.

Professional Development—Charles H. Thuman, project engineer, Whirlpool Seeger Corp., Evansville, Ind.

Program—James R. Matthew, mechanical design engineer, Hughes Aircraft Co., Culver City, Calif.

Public Relations—Frank Ritchie, manufacturing engineering director, Ford Motor Co., Toronto, Ont., Canada.

Research Fund—Howard C. McMillen, manufacturing manager, Copeland Refrigeration Corp., Sidney, Ohio.

Standards—Arthur E. Crom, tool engineer, Consolidated Vultee Aircraft, San Diego, Calif.

Technical Publications—Raymond E. Gariss, senior tool design engineer, Douglas Aircraft Co., Long Beach, Calif.

The president of ASTME in 1958-59, George Goodwin, is permanent chairman of the *Long-Range Planning Committee*.

Directors Approve 1961 Budget

Meeting during the Detroit conference, the ASTME Board of Directors reviewed individually the annual reports of the national committees. The directors then acted upon recommendations made by the national officers concerning each report.

Review of the National Finance Committee's report resulted in the approval of $867,650 as the amount of the fiscal year 1961 budget. This figure carries with it reductions in the budgets of the various national committees. When it was revealed that the sums allotted each group would be smaller than in the recent past, the suggestions to hold fewer meetings and perhaps maintain fewer members on the committees were made. The officers, directors and committee chairmen all agreed these would result in considerable savings.

The results of negotiations between the National Program Committee and the Honor Awards Committee concerning the establishment of an award, tentatively to be known as the "Outstanding Paper Award," were also aired at the board meeting. It has been proposed that an honorarium go to the writer of the best technical paper to be presented at the annual meetings of ASTME. A committee will be appointed to choose the award-winning paper.

Funds were also granted the Research Fund Committee for publishing the *Metalcutting Bibliography*.

Conference Highlights

THE GREAT INDUSTRIAL CITY of Detroit welcomed "its own" back home during ASTME's eight-day Engineering Conference and Exhibit. As the birthplace of the Society and its present headquarters—as the site of the very first ASTME show in 1938—as the city with the largest per capita volume of manufactured products in the country, Detroit is indeed the logical meeting ground for tool and manufacturing engineers.

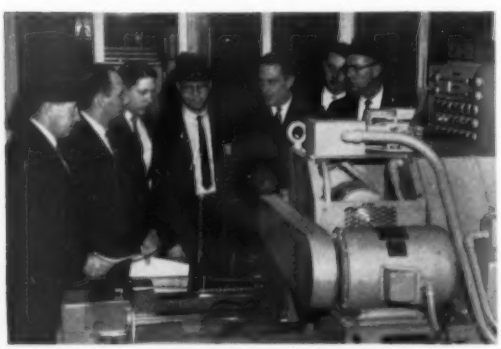
Taking the lead in making almost 40,000 of them welcome was the Detroit Host Committee, headed by Past President Leslie B. Bellamy. Hundreds of visiting wives shared in the welcome, too, and partook of a round of activities that included a fashion show, assembly line visits and tours of the city. Mrs. Joseph F. Wrobel, wife of the Detroit Chapter 1 chairman, directed the distaff program.

Thousands supplemented their show visits with plant tours, technical sessions and sightseeing. Hundreds of them took part in ASTME proceedings on the occasion of the Society's 28th Annual Meeting.

The 33 technical sessions, ranging from the engineer in medicine to a symposium on automation, drew 2176 registrants. A dimensional metrology seminar pulled in 825 people, for a total technical-paper audience of 3001. Average attendance at each session thus topped 90.

Two days were devoted to the annual Leadership Conference for the Society's chapter leaders, the chairmen and first vice chairmen of the 166 senior chapters. Experts led sessions on training not only for Society management, but also for personal and professional leadership.

Dr. Ross M. Trump of Washington University, St. Louis, sounded the challenge of leadership in the Sixties. "For the company which goes courageously ahead, dramatically undertaking new developments, new applications of the results of research, this will be a dazzling decade," he said. "But for the company which is complacent in any degree, this is clearly a dismal decade."



A group of Detroit Engineering Conference registrants touring Ex-Cell-O Corp. plants stops to examine a numerically controlled contouring machine in an air-conditioned enclosure. All but the last two of 17 scheduled plant tours in the Detroit area were subscribed to the limit.

Engineers Urged To Take Part in Public Affairs

One of the most challenging but most sparsley attended special programs of the conference was a panel discussion of the engineer's responsibility to his community.

One of the panelists, Utah Gov. George D. Clyde, who is an engineer himself, deplored the fact that "engineers as a class tend to fall below the norm in their acceptance of community responsibility." The engineer is peculiarly needed on the political scene nowadays, Clyde went on, because he is trained to gather the facts, analyze the facts—and face the facts.

Dr. Stanley J. Idzerda, Honors College director at Michigan State University, gave some apparent reasons for engineers' tendencies toward clannishness. Aside from temperament ("they would rather deal with things than with people"), he traced the principal blame for engineers' withdrawal from society to narrow curricula.

"Industry demands the production of specialists, of technocrats," Idzerda said. "Industry and management are corrupting the engineer graduate with lures of annuities, pensions, barbecue pits and other garbage. Last year, 784 companies interviewed MSU students—and all harped on security and the country club goals in life . . . . We in education need clearer signals from industry."

Arthur S. Griswold, Detroit Edison Co. vice president, described his firm's active campaign to interest employees in government. He said 60 to 70 percent of the company's management personnel are engineers who have been exposed to civic and community responsibilities.

"A company need not be large to distinguish itself as a community servant," he said. "It can do so by contributions, counsel and advice in civic efforts, encouragement of good citizenship above and beyond the duty of voting."

The need for grass-roots political action was em-

phasized by Herschel C. Atkinson, executive vice president of the Ohio Chamber of Commerce. The panel was moderated by Thomas R. Reid, civic affairs director of Ford Motor Co., who described his company's "Effective Citizenship Program" wherein employees are urged to enroll in nonpartisan politics courses, volunteer for service in the party of their choice, and give financially to their party.

At a Business Outlook Luncheon sponsored by THE TOOL ENGINEER, Paul Carnahan, board chairman of Great Lakes Steel Corp., warned that labor must face up to the fact that it has a stake in America's economic fortunes in the Sixties.

"Unless organized labor reappraises its role in the economy, we are in danger of losing an even greater percentage of our domestic business," he said. "We cannot consistently raise wages year after year beyond our capacity to produce—or to compete in world markets with low-cost foreign labor."

More participation by the rank-and-file union member in union affairs, Carnahan declared, is needed to bring about this necessary new direction of thought.

Other panelists, who were quizzed by business editors of the metropolitan press, included Joseph L. Hudson, Jr., general manager of J. L. Hudson Co., Detroit's largest department store; Charles H. Schmidt, National Bank of Detroit vice president; and Paul W. McCracken, University of Michigan economics professor.

NAM President Attacks Roadblocks to Prosperity

Rudolph F. Bannow, president of the National Association of Manufacturers and sometimes referred to as "the top Bananow," told an audience of 300 what he believed to be the major roadblocks hindering industry's, as well as the country's ability to achieve a sound economy. Bannow spoke at the April 22nd Industrial Progress Dinner.

The five problems he cited were inflation, foreign competition, labor-management disputes, government economy and tax rate reform.

Of the first point Bannow plainly stated, "We can't get away from inflation." Foreign trade and competition are the chief problems now, he said. The NAM chief is serving on a five-man committee assigned to alert the nation to foreign trade upportunities.

"We face a world tooled up and ready to compete," he said. "Whereas in the past there was a vast difference between the U.S. and European production techniques, overseas companies are now employing modern methods that equal and even excel those in America."

The nearly three-to-one wage gap existing in America today is part of the difficulty in meeting competition in world markets, Bannow continued. He called for the cooperation of both labor and management in closing this gap.

In his discussion of government economy Bannow wasted no time in hitting upon the Forand bill, which proposes federally supported health insurance for the aged through increased Social Security taxes. Bannow said there is "no reason why we should ship money to Washington so they can ship it back to us. Why not do the job on the state or local level?"

The "cockeyed tax law" was next in Bannow's line of fire. This country needs more jobs and more job makers, he said. But to create jobs is to become "public enemy No. 1." The present tax laws say it's immoral to create jobs. If the brakes were taken off the job maker or business man, he might invest in new plants and new jobs. This might create a few millionaires, Bannow concluded, but the one who stands to gain is the worker.

¿Que es la ASTME?

Two yard-wide sombreros and a mile-long greeting from the new ASTME members south of the border brought smiles to the faces of the Annual Banquet crowd in Detroit's Statler Hilton Hotel ballroom the evening of April 27.

The straw sombreros had been prominently in evidence during the preceding Leadership Conference and other convention events, announcing on their brims the presence of the "Mexico 166" delegate and alternate delegate underneath them.

Julio Garcia, chairman of the Society's baby chapter in Mexico City, presented the sombreros to outgoing President Wayne Ewing and incoming President H. Dale Long after the installation ceremonies.

Then Garcia delivered his message—a string of well-chosen Spanish words which he translated simply as "Howdy."

"We are proud," he continued, "that the Society has seen fit to recognize us with an official charter. In fact, we are flattered that the Society has even seen fit to change its name for us. We're proud to be a part of the American Society of Tool and Mexican Engineers."

3:30 pm, April 21, the first of 33 technical sessions began at the Detroit Engineering Conference. Shown entering the "Medicine-Surgery-Engineering" session are its main participants. Left to right are Karl G. Novak, Fenwal Inc., who was chairman of the session; Dr. Carl W. Walter, an associate professor at Harvard Medical School and surgeon at Peter Bent Brigham Hospital; John W. Greve, editor of THE TOOL ENGINEER; and Willis C. Gorthy, director of the Institute for the Crippled and Disabled.

CONFERENCE

A reception preceding the Eli Whitney Memorial Lecture gave this newspaper reporter an opportunity to talk with the speaker, Dr. Allen V. Astin (left), director of the National Bureau of Standards. Astin's talk dealt with "The Basic Standards of Physical Measurement." Astin said, "We are moving away from arbitrary man-made standards to a system based on physical constants."

The day-long Canadian Caper attracted some 75 ASTME wives. They are shown here boarding the bus that took them through the Detroit-Windsor tunnel for a tour and some shopping in Canada. In all, about 200 ladies attended the conference. A ladies activities committee headed by Lorraine Wrobel, wife of the Detroit chapter chairman, scheduled such things for the wives as tours of the General Motors Technical Center and Chrysler Corp. assembly lines, a J. L. Hudson fashion show, and a joint husband and wife visit to Greenfield Village and the Henry Ford Museum located in nearby Dearborn.

Two men of destiny, Charles Stewart Mott (above), president of the foundation bearing his name, and Dr. Norbert Wiener (right), professor of mathematics at M.I.T., received ASTME Honor Awards from Past President Wayne Ewing. Others who received national awards at a dinner in their honor were Ralph J. Cordiner, chairman of the board at GE; Edward E. Griffiths, consulting engineer; Frank Martindell, consulting engineer; and Edward Varnum, head of operations research, Barber-Colman Co.

CAMERA

The chairman of the oldest met the first vice chairman of the newest ASTME chapter at the Leadership Conference in Detroit. After the conference Joseph F. Wrobel of Detroit Chapter 1 agreed with Ray A. Gast of Mexico City Chapter 166 that you can never learn enough about running a chapter, whether it be 28 years or just two months old. The Mexico City chapter was chartered on April 8. Julio N. Garcia was installed as its chairman.

The reputation of ASTME seminars continues to grow as was evidenced by the large number of representatives from foreign countries who registered. Muzaffer Cemal Kulur, director of organization and training, Makina Ve Kimya Endustrial Kurumu, Ankara, Turkey, confers here with Sara Graff of the ASTME staff before entering the "Dimensional Metrology" seminar. Among other countries represented were Sweden, Mexico, Chile, France, India and Japan. The dimensional metrology program was one of ASTME's creative manufacturing seminars.

Richard A. Green

Members in the News

RICHARD A. GREEN, registered professional engineer and a member of Detroit chapter, has been appointed vice president and general manager of the Pioneer Industrial Engineering Div. of Pioneer Engineering & Mfg. Co., Inc. At the same time he was elected to the board of directors. For the past year Green was general manager of the Douglas Tool Co., a division of Pioneer, and formerly was general manager of the Metal Products Div. of National-U.S. Radiator Corp.

JOHN E. WILSON, who has held office as treasurer, second vice chairman, first vice chairman, and has recently been installed as chairman of the Golden Gate chapter, has been appointed manager of manufacturing of the Marchant Div. of Corona Marchant, Inc. Wilson, who has had experience in all facets of Marchant's manufacturing activities, began his career in 1944 in the tool and die division. Advancing from the post of plant manager, he now assumes responsibility for all factory operations at the Oakland, Calif., plant, which manufactures calculators and adding machines.

Appointment of EUGENE MAKIE to vice president in charge of manufacturing for the National Automatic Tool Co. has been announced. He comes to Natco from the Utica Div. of Curtiss-Wright Corp., where he was general manufacturing manager. For a number of years he was manager of manufacturing engineering at the Dearborn plant of Ford Motor Co. and prior to that, industrial engineer at Evans Products Co. Makie has been active on various committees for the Detroit chapter.

John E. Wilson

Eugene Makie

JOHN S. RICHARD, JR., Hartford chapter, has been appointed eastern manager for American Drill Bushing Co., Los Angeles. Before his appointment he was regional manager for the company in the same eastern territory. In his new capacity Richard coordinates sales and engineering services of the firm.

GREGORY A. MANCHESTER, past vice chairman and secretary of Detroit chapter, has been appointed to the creative and account-service staff of Denham & Co. He was formerly advertising, public relations and sales-promotion manager for several major industrial organizations.

PETER S. SANDERS has been appointed plant manager of the Congress Die Castings Div. of Tann Corp., Detroit. A die-casting manufacturing executive since 1942, Sanders was previously die-casting superintendent at Ford Motor Co.'s Rawsonville, Mich., plant. . . . After 19 years with Illinois Tool Works as sales manager of the Tool and Instrument Div., ROBERT E. WOLFF has been elected vice president, marketing, of the Van Straaten Chemical Co. . . . ALFRED E. FASULO, recently promoted to chief tool engineer for the Wallace Barnes Div. of Associated Spring Corp., was first employed by the company in 1937 in the Dunbar Div. Later transferring to the Wallace Barnes Div., he has been serving as supervisor of the tool design department. Fasulo is a member and former officer of the Central Connecticut chapter.

Formerly district sales manager for the Los Angeles branch of Columbia Tool Steel, FRED G. PORTER of San Gabriel Valley was transferred to

Magnus A. Grunlan **George H. Whitehouse**

the Cleveland branch in the same capacity . . . STUART A. SMITH, associated with Firth Sterling Co. for ten years as district sales manager, has been appointed general sales manager of the Tool and Instrument Div., Illinois Tool Works . . . . JOHN KRAUS, who has been active in Buffalo Niagara chapter for a number of years, has been appointed field sales representative in southern Ohio for The Allen Mfg. Co. Kraus, whose territory will cover Cincinnati, Dayton, Columbus and Springfield, was formerly with the Buffalo Die Supply Corp. and E. W. Bliss Co. . . . A registered professional engineer in Michigan, WALTER R. OPEL, Detroit chapter, has been appointed chief engineer for The Cross Co., Detroit. Opel, who has most recently been engineering manager, will supervise the design teams creating Cross special-purpose machine tools. Prior to joining Cross he was chief engineer of Efficient Engineering Co.

MAGNUS A. GRUNLAN, Greater New York chapter, has been named manager of production engineering by Resistoflex Corp. Prior to his association with this firm he was works manager for Intertype Corp. . . . ANDREW N. KANE, Cleveland member, was appointed district sales manager of the Detroit branch of Columbia Tool Steel Co. He was formerly with the Cleveland branch in the same capacity. . . . Appointment of EDWARD J. STRONG as southwest regional manager for the Industrial Controls Section, Bendix Aviation Corp., has been announced. He will be in charge of sales and applications of Bendix numerical control systems for machine tools in a number of southern states. For the past five and a half years Strong has been a machine tool sales engineer in Texas.

Van Keuren Co. has announced the appointment of FRANK D. CLARK as director of the newly created Thread and Instrument Div. Clark, a member of Boston chapter, has been with the company for 20 years, having served as head of the gage block department, secretary of the corporation, member of the board and manager of field sales and services. The new division will manufacture and distribute the company's line of thread gages, thread comparators, air gages and other measuring instruments. Clark has recently returned from England, where he made an intensive study of English methods of thread gage production and manufacturing.

GEORGE H. WHITEHOUSE, vice president of sales for Snyder Corp. since 1946, has retired. The president of the company paid high tribute to the service rendered by Whitehouse to the company since joining its sales staff in 1931. He will continue as a member of the Snyder Corp. board of directors and serve as a consultant. In the 17 years prior to joining Snyder Corp., Whitehouse worked for several automotive companies and supplier firms in various drafting, tool procurement, production and planning capacities. He joined ASTME in 1938 and served the Detroit chapter in many capacities, including its chairmanship in 1943.

FRANK G. GUSTAFSON, member of Worcester chapter, has been appointed supervisor of the engineering department in Plant 7 of Norton Co. Joining Norton in the sales training course in 1952, Gustafson has worked successively as grinding engineer, sales engineer, supervisor of the sales engineering department and chief sales engineer of the abrasive division.

FRANK W. HOGAN has been appointed to the newly created position of marketing manager for Adamas Carbide Corp. Formerly sales manager, Hogan will be in charge of all the firm's marketing functions, including sales promotion, advertising, public relations, market research, service engineering and new product developments. Hogan, a member of Northern New Jersey chapter, was formerly sales manager for American Ball Bearing Corp.

Does Industry Need Experts—or Imperts?

In this heyday of the expert, industry could often use just the opposite, registrants at the University of Wichita's Second Annual Production Institute were told. The speaker—Jonathan Ewert of the Coleman Co.—was one of eight experts assembled to explore the program's theme, "Producibility, the Key to Cost Reduction."

Ewert said that manufacturing plants generally are in dire need of "imperts," as opposed to experts. Rather than attacking problems by conventional, prescribed patterns of thought as does the capable expert, the "impert" that Ewert had in mind would approach problems unconventionally, originally, creatively.

Managers have the primary responsibility of developing such "imperts," the speaker added. He recommended that enlightened industrial leaders encourage their employees to do research, read trade journals, join and participate in professional societies such as ASTME, attend seminars and training sessions—in short, become a part of any activity where the dissemination of information is likely to motivate revised and original thinking.

Thomas Nichol of Lincoln Electric Co., St. Louis, also spoke on producibility as it pertains to employees. In a digression from his theme of "Reducing Costs Through the Use of Weldments," Nichol discussed his firm's operating philosophy concerning its employees, with particular attention to its incentive program. Time study engineers and their role in helping motivate maximum producibility came in for praise from Nichol.

Cites Disparity in Wages, Production

Two men from Wichita's Boeing Airplane Co. plant called institute registrants' attention to other aspects of the producibility picture. Lynn Whiteside noted that during the period 1950-57, product output in this country rose 28 percent while wages went up 48 percent. This disparity, plus a number of other challenges such as foreign competition, poses increasing problems to industry. And the solution, Whiteside said, seems to lie at least partially in the area of producibility.

Roy Myer, also of Boeing, suggested concentrating on the "point of reliability" in tool design. He presented some examples where adherence to this principle resulted in cost reductions. He also stressed the importance of the tool and product designer working together in the development of economically justified tools.

Forming metal parts with the application of high explosives and electric discharges in water was the subject of a presentation by Warren Fedderman of Convair. He said the somewhat spectacular techniques had been considerably successful at his plant in forming hollow type bodies and cups, but somewhat less successful with channels and flat panels.

In detailing the electrical discharge technique, Fedderman said that a tungsten initiator wire tied to the electrodes had reduced the voltage required for a given impact from 24,000 to 6000. He added that the design—or curlicue—in the initiator wire determined the nature of the pressure or shock waves produced, and thus permitted the formation of more complex parts.

Fedderman emphasized that such techniques being used at Convair are still primarily experimental, and are employed outside and away from the plant proper.

Continuity of Thought Is Stressed

Three other speakers—George Main, Arwood Precision Casting Corp., New York; Glen Zimbehl of the Aluminum Company of America, Vernon, Calif.; and George Gasbarre, Brockway Metals, St. Louis—discussed investment casting, aluminum forgings and powder metal parts. All agreed that a number of variables, such as type of material, size, shape, density, functional requirements, production quantity and so on, must be considered before determining the raw material and forming method best suited for maximum producibility. Examples pointed up this common but significant experience: analysis of the original design by the parts manufacturer often resulted in changes which produced substantial cost savings to the customer.

Either explicit or implicit in the discussions at the Wichita conference was the feeling that continuity of thought between the design engineer on the one hand and tooling and manufacturing personnel on the other is the key to producibility.

For the first time, sons came along to the Iowa on-campus conference with their engineer fathers. Here, trying out the drop forge in the university's engineering lab, is Tom Hruska. Standing by is Phillip A. Less. Both are sons of Chapter 71 members.

Iowans Focus on Future of Low-Volume Production

SOME ADVICE on the ruthless economics of economy was tossed at 125 tool and manufacturing engineers during an April thaw conference on low-volume production at Iowa City.

"If you can invest in a machine that will produce a year's supply of a given product in a day—that will take three years to pay for itself—would you buy it and throw a tarp over it for 364 days?

"Why not?

"If it checks out as being more economically feasible in the long run than the old machinery you now use to produce a year's supply of that same product, then why not buy it?

"Don't let the price of numerical control scare you out of using it in low-volume production. If you can use it, it will pay off for you in a hurry."

The speaker was David N. Smith, chief development engineer for Jones & Lamson Co., Springfield, Vt., who set out to show that his subject—automatic control in manufacturing—was not necessarily out of place at a low-volume conference. The occasion was the sixth annual On-Campus College-Industry Conference at the State University of Iowa, sponsored by the Cedar Rapids chapter of ASTME and the Mechanical Engineering Department of the state university.

Numerical control was for a long time confined to mass production, Smith said, because of its cost; but now, because of its cost-savings, it is definitely headed toward lower production. He added his opinion that the ultimate effect of widespread automatic manufacture on employment will be to in-

crease it, although the future emphasis will be on technical sophistication and know-how rather than on skilled or semiskilled labor.

Russell F. Novy, assistant director of research, Lindberg Engineering Co., Chicago, predicted that whole plants or whole departments of plants would have controlled atmospheres. In a talk on "Trends of Controlled Furnace Atmosphere and Associated Heat-Treating Equipment," Novy foresaw the day when employees in plants working with the new alloys and precious metals would go around all day in suits to match their space-age counterparts in the rocket ships of the future.

Presiding at the morning session was Fred N. Abel, incoming chairman of Cedar Rapids Chapter 71; at the afternoon session, Chairman Clifford Vogt, Tri-Cities Chapter 23. Other speakers included M. L. Backstrom, Carbide Div., Firth Sterling, on carbides; David R. Kelker, Air Reduction Co., on welding; and Richard M. Radl, Collins Radio Co., on plastic tooling. Prof. Kenneth J. Trigger of the University of Illinois, member of the ASTME National Education Committee, stressed the value of such campus conferences in providing a forum for exchange of ideas.

A special feature was a university-produced film of a surgical operation performed on the heart of a girl.

Also special about the conference was the turnout of engineers' wives and sons. Some 40 wives and teen-agers attended a program of their own, which included lectures and demonstrations in the mechanical engineering labs.

In a state where signs announce at all the airports that Iowa is "where factory and farm share prosperity," the ASTME conference on low-volume production was particularly well taken. Cedar Rapids chapter is already planning the 1961 conference.

Somewhat apprehensively checking over her first weldment is Mrs. Russ Swearingen of Marion, Iowa, wife of the Cedar Rapids immediate past chairman.

A cautious onlooker is Mrs. Lois Markstrom, also of Marion. Holding the "thing" that the lady has wrought is an engineering student at the university.

Registration Bill Causes

Controversy in Canada

OF SOME CONCERN to many of the 1830 ASTME members in Canada is an engineering registration bill now before the legislature of the Province of Ontario. The measure, if passed, could endanger the Society's future existence in the province under its present name. Other societies and organizations would be similarly affected.

According to National Director Bruce Fairgrieve, the legislation would "virtually give the Association of Professional Engineers of Ontario the legal right to regulate the use of the word 'engineer' by any and all societies, associations and persons." However, organized opposition to the move has taken the form of several briefs which, the various sponsors hope, will prevent the bill from becoming law without some modifications. The ASTME is among the organizations which have submitted briefs.

Officially labeled the Professional Engineers Act, 1960, the proposed Bill #36 has been through its first and second readings before Ontario's 26th Legislature. Pending an opinion on the bill's constitutionality, final action has been tabled until the legislators reconvene for their second session this fall.

Sect. 23 of the bill, as amended, would read:

"Only a person who is a member of the Association [the APEO] or who has obtained a license is entitled to use the designation 'Professional Engineer,' or any abbreviation thereof, or, except as otherwise provided in this Act, to use the designation 'Engineer,' or any abbreviation thereof, in such context or in such manner as to lead to the belief that he is a professional engineer."

All but 295 of the 1830 members in Canada are in Ontario's eight chapters: Toronto, Windsor, Hamilton District, Niagara District, Grand River Valley, London-St. Thomas, Ottawa Valley and Peterborough. Montreal, in Quebec, accounts for the 295.

The APEO has quasi-official status in the province; all its bylaws must be approved by the Lieutenant Governor in Council.

Attempts of an APEO group employed by the Ontario Hydro Electric to obtain compensation by collective bargaining set off the furor in Ontario engineering circles. The provincial attorney general presented Bill 36 in an effort to punish illegal use of the word engineer. The registration program in Canada now recognizes these descending categories of professional attainment: professional engineer; technologist; technician Grade I, II and III; and craftsman.

Concerning professional development activities in Canada, Eric I. Browne of Islington, Ont., reported recently to the Society's National Professional Development Committee in his capacity as Canadian representative on the committee. Browne, himself a professional engineer, emphasized that the Society has a big job to do in Canada in the technician-technology areas. "To gain professional recognition as professional engineers for our members without university standing," he asserted, "is well nigh hopeless, and the door is closing tighter all the time."

Need for Accredited Technicians

Toronto Chapter 26 was selected as a guinea pig this past year, Browne reported, to see if ASTME could stimulate interest in upgrading its members through the APEO to technicians Grade III or better. "Our prime difficulty is the fact that the technician-technology program here is still in its infancy, and comparatively few employers are aware of the situation, so that they are likely to ask for or demand ratings for prospective employees.

"In a province where we have 19,000 registered professional engineers, we have at the start of 1960 only about 600 registered and accredited technicians. When this number is multiplied by 100, we will then be in a vastly different position and the problem of interesting our members will be simplified. This will take a number of years and a lot of publicity."

Courses were run this last year in a number of Canadian chapters with the object of technical advancement in knowledge, but there was no professional recognition for such work, Browne said.

Chips and Chatter

New York Mayor Robert F. Wagner presents Dominic R. Scolaro (right) chairman of GREATER NEW YORK chapter, and Alfred M. Sampter (left), vice chairman, with an official document proclaiming Monday, May 2, as Tool and Manufacturing Engineers Day in New York City. The day's activities included a tour of Grumman Aircraft in Bethpage, L. I., technical sessions, and a windup banquet with James Low of the NAM discussing the "Tool Engineer's Changing Role in New York."

QUOTE OF THE MONTH: "The poet Dante said the hottest places in hell are reserved for those who at the time of greatest crisis stoutly maintain their neutrality. This sounds like a description of some of my engineering friends."—Dr. Stanley J. Idzerda, dean of the Honors College at Michigan State University, during a Detroit Engineering Conference panel discussion of the engineer's responsibility to his community.

A past chairman of NASHVILLE chapter, Fred D. Wright, has returned from the Philippines. Head of a tool and die firm in Nashville bearing his name, Wright toured the islands as one of a six-member Department of Commerce trade mission. The purpose of this mission was to strengthen already-established commercial ties and explore new trade possibilities with the Philippines.

A Frenchman of Swedish descent who is a member of LONG ISLAND chapter talked technical English —with some Gallic gestures—during a visit at Society Headquarters. Serge A. Golbert, chief of production research at Sud-Aviation in Paris, is shown demonstrating the difficulties of translation to a sympathetic audience in the technical publications offices at Headquarters. Technical Director Frank W. Wilson (left) and an assistant, Walter Prange. Golbert came by for consultations on his role in the preparation of the projected ASTME book on tooling for aircraft and missile manufacture. The Paris engineer, who has been with Sud-Aviation for 34 years, joined Long Island Chapter 88 in 1957 while on detached duty at Republic Aviation Corp. His French firm designed and developed the medium-size Caravelle jet, which recently made international news when Douglas Aircraft purchased the rights to make and market it. Golbert saw the Detroit Tool Show from start to finish. . . .

chapter news

Expert Traces Rocket History From Quang-Ho to Von Braun

TWIN CITIES—Back in the 13th century Emperor Quang-Ho decided to have himself shot off into space with the aid of 20 sky rockets. This is the first record of any attempt at interplanetary space travel, Bernard J. Meldrum of Chrysler Corp. told his audience at the April meeting of Chapter 11.

Meldrum, who is special assistant to the general manager of the Missile Operations Division, brought the discussion up to this century when he spoke of the work of an American, Professor Goddard of Clark University. In 1919 Goddard published the first modern theory of space travel. He was either ridiculed or ignored and, being a shy individual, he preferred not to push his work in the face of this criticism. But, said Meldrum, his theory did not go wholly unnoticed.

A young man in Germany, name of Werner Von Braun, was reading the professor's work with great interest. He approached the German military authorities and gained their support in his rocketry research—research which culminated in the development of the V-2 buzz bomb. Scientifically, the speaker continued, the bombs were a success, but because of the type of warhead used, they were simply a source of harrassment to the British. If the Nazis had used the scientific talent they had at their fingertips (Einstein et al) to develop nuclear warheads to power the V-2, the whole course of the war might have been changed.

"After World War II we lost six years' time in developing rockets, while the Russians carried on a crash program to develop intercontinental ballistic missiles and satellites," Meldrum said. "We did not really get into gear until the Russian Sputnik electrified the world." The young German is a U. S. citizen now and has turned his talents from buzz bombs to more far-reaching projects. His latest design is a rocket, 188 ft high, weighing in excess of a million pounds. Meldrum stated that this rocket would be capable of taking a 38,000-lb payload to the moon, but not back.

Although we have come a long way in rocket development, there are problems that must be solved before interplanetary travel can commence. Meldrum listed some of these problems as: ability to generate thrust for the required velocity to leave the earth's gravity, enter the gravitational field of another planet, and return; control for the whole operation; re-entry heating, since any re-entry unless controlled would be like that of a meteor; weightlessness when in space; vision, since in total darkness the sun and stars would be blazing sights; adjustment to changed life cycles, no day and night would impose an artificial life cycle on astronauts; breathable atmosphere; collision with asteroids; and penetration of the Van Allen radiation belt.

Meldrum concluded by raising the question—Why tackle space? He said the only rationalization for space travel is the rebirth of astronomy or the discovery of the secrets of the sun and its continuous nuclear power, an unlimited source of power for use by earthmen. *—Ed Gillaspy*

LOUIS JOLIET—Harry J. Moffatt (left) received a 1960 Award of Merit at a recent meeting of Chapter 104. Presenting the ASTME award to him here is Don Domnick, chapter chairman. *—Gene Senn*

SEATTLE—A forged track shoe held by Chapter 39's speaker at the March meeting, Eric Kinnaird, chief welding engineer at Pacific Car & Foundry Co., is inspected by (left to right) Gordon Duncan, chairman; Clarence Downie, past chairman; and Cal Jones, program chairman. *—Ralph F. Ingebretsen*

Submarine Expert Describes U. S. Underwater Might

CENTRAL CONNECTICUT—Nuclear submarine development in America today—where we stand now, how we arrived at that point, and what we can expect in the future—was the topic discussed at Chapter 148's March meeting. The speaker was Commander E. R. Eberle, U.S.N. Ret., now test superintendent for research and development, Electric Boat Div., General Dynamics Corp. Eberle has held this job since 1953, supervising the tests and trials of some 18 submarines, including the Nautilus.

On hand to hear Eberle speak was the local chapter of the JETS (Junior Engineering Technical Society). The students were presented with special slide rule membership pins.

Eberle indicated that our present capability in nuclear subs has been proved by the successful tour of the Nautilus beneath the polar ice cap. He said that the Skate and the Seawolf had also probed the North Pole area, the latter staying there for 59 days.

Three major breakthroughs have accounted for our present firm status in the submarine field. Eberle put these into the classifications of propulsion from a nuclear power plant that can sustain a sub for over a year without replenishment; speed; and nuclear armament.

Of this last point Eberle stated that an atomic sub capable of carrying 16 Polaris missiles programmed in advance by electronic computers is now in existence. These missiles, which possess a range of 1600 miles, utilize IBM computer systems in correcting their accuracy on target. This accuracy is usually within one-and-a-half miles of the target. The destructive power of these 16 missiles would be equivalent to all the bombs dropped by the allies during World War II, Eberle said.

The speaker emphasized that the enormous destructive power of a nuclear sub, coupled with the fact that no positive means have been developed to detect and destroy a sub beneath the polar ice cap, is at present the greatest deterrent to war.

index

Purdue Schedules Summer Metal-Processing Seminar

LAFAYETTE, IND.—A two-day summer-school con-

LORAIN COUNTY—Past Chairman Carl Mourning installs the 1960-61 officers of Chapter 134 during meeting at the new Masonic Temple in Elyria, Ohio. Left to right with Mourning are William A. Lauck, chairman; Elton R. Becker, first vice chairman; Lloyd H. Petty, treasurer; Edward Reindl, secretary; and Alex Taylor, second vice chairman.

SAN GABRIEL VALLEY—Outgoing chairman, Russell J. Stainton, presented Chapter 95's outstanding service pin to Mrs. Evelyn Martens for the time and effort she donated to the group's chapter bulletin. The wife of member William Martens, she was the first non-ASTME member to receive the pin.

—Bernard K. Allen

ference on metal processing is being sponsored by the American Society of Engineering Education in cooperation with ASTME at Purdue on June 24 and 25. Aimed at industrial engineering educators, the conference will feature both educators and industrialists as speakers. ASTME's president, H. Dale Long of Scully-Jones & Co., will talk at a luncheon meeting on the second day of the conference.

Educators recruited for the program include Orville Lascoe, Purdue University; Prescott Smith, M.I.T.; Bert Norem, Syracuse University; Horace Frommelt, Spring Garden Institute; L. V. Colwell, University of Michigan; and K. T. Trigger, University of Illinois.

A panel of four men will review the industrial side of the metal-processing picture. They are Dr. W. W. Gilbert, General Electric Co.; Carl Oxford, Jr., National Twist Drill Co.; H. C. Reel, Westinghouse Electric Corp.; and Edward Reed, General Motors Corp.

Record Crowd of 550 Attend Rockford Tape-Control Forum

ROCKFORD—By distributing tickets through the membership to interested parties in local companies, Chapter 12 drew a crowd of 550 to its March 24 special forum meeting. This established a record for any function ever held by the Rockford ASTME group.

The subject of the meeting was the application of tape-controlled machines to today's manufacturing. Moderating the panel discussion was Ernie Seborg of Ingersoll Milling Machine Co. The three-man panel consisted of John A. Hansen, Kearney & Trecker; T. L. Jenner, Pratt & Whitney; and Bert Anderson, Sundstrand Machine Tool Co.

An active question and answer period continued long after the meeting was supposed to have been adjourned. —*R. C. Bowen*

350 From Four Chapters View Miniature Bearing Facility

MONADNOCK—Over 350 members and guests from four ASTME chapters in New Hampshire, Vermont and Massachusetts met for a dinner and tour of New Hampshire Ball Bearings, Inc., on April 21. Representatives from Twin States chapter, Merrimack Valley chapter, Northern Massachusetts chapter, and Monadnock chapter turned out for the combined session. The National Guard Armory had to be engaged at the last minute to accommodate a late rush of reservations generated by the first-of-its-kind meeting in the area.

The main speaker at the event was Arthur N. Daniels, president of the ball-bearings firm. He outlined the processes and techniques employed in miniature instrument bearing manufacture.

MACOMB—The installation of Chapter 142's new officers occurred at the March meeting with Leslie Bellamy (left) past ASTME president, presiding. Here Bellamy congratulates the officers. From left they are: Ted Ekman, chairman; Mike Bentz, first vice chairman; Bill Lyons, second vice chairman; Bernard H. Gulczewski, treasurer; and John Preece, secretary.

The evening wound up with a tour through the company's recently renovated and expanded miniature bearing production and engineering facility. The ASTME members were the first to inspect the 40,000-sq ft addition and the renovated main plant which authorities declare to be the most modern miniature bearing facility in the world. The members' tour preceded the official opening by the firm by two days.

Chapter 27 Installs Officers, Presents $250 Scholarship

LOS ANGELES—The chapter's March meeting had a three-fold purpose. The first was the installation of officers by Wayne Ewing. Those taking the oath of office from the immediate past president of ASTME were: George Tilden, chairman; Russell W. Lamb, first vice chairman; Frank A. Gonzales, second vice chairman; George C. Adams, third vice chairman; Lyle D. Wood, secretary; and Harry W. Schlentz, treasurer.

The meeting's second highlight was a talk on the manufacturing uses of closed-circuit television by C. M. Brainard, vice president of Reeves Electronics, Inc. The 164 members and guests present were treated to a live demonstration of actual cameras and monitors.

A $250 scholarship was presented to Philip J. Brashear, a senior at California State Polytechnic College and a member of the ASTME student chap-

ter there. Brashear received the award from Chapter 27 as the outstanding senior engineering student planning to follow a tool and manufacturing engineering career. This scholarship is presented yearly.

—Brian Mahoney

Hydroforming and Hydrospinning Differentiated at Indianapolis

INDIANAPOLIS—John McCormack, field engineer for the Meta-Dynamics Div. of The Cincinnati Milling Machine Co., demonstrated the differences between the hydroform and hydrospin processes for 140 members of Chapter 37 at a recent meeting.

The first method of chipless machining discussed by McCormack was the hydroform process which, after nine years in the experimental stage, has resulted in a modern hydroform press. The machine can form or draw relatively heavy sheets of stainless or semiexotic metals.

All movements and pressures of which the machine is capable are subject to infinitely variable control. This feature lends itself to either a sizeable production lot of pieces or to a single piece. The ability to manually stop at any point, retract for examination, and then resume the stroke has great value in developing a single prototype part. If this type of action should become necessary on a production part it could be scheduled and accomplished in an automatic cycle, McCormack said.

Hydrospinning is a power spinning process, McCormack continued. It is further a process wherein, using a lathe type machine, a workpiece is forced to take the shape of a rotating mandrel by employing a hardened and polished rolling tool mounted on a tracer-controlled cross slide. This tool, while working, applies simultaneously the three basic factors of squeezing, stretching and shear deformation.

The hydrospin lathe can handle blanks which may be either round sheets or pancake forgings of familiar alloys and stainless steels. Using the 225,000-lb tool force which is available on a vertical model is really putting a power spinning machine to work, McCormack concluded.

This meeting also saw the presentation of an Award of Merit to Joseph N. Huser, Sr., a past chairman of the Indianapolis chapter.

—James J. Denney

PEORIA—Mapping their chapter's future for the year ahead are Peoria's new officers. Installed at the March meeting by National Director Duane Brighton were (seated, left to right) Walter Bristow, first vice chairman, and Charles Tobin, chairman. Standing are Ed Weber, secretary; Olin Simpson, second vice chairman; and Howard Poland, treasurer.

—Vince Ekiss

positions

wanted

DIE-CASTING ENGINEER—with 20 years' experience available after June 1, 1960. Ten years in die design—last ten as superintendent of complete operation from estimate through production. Sales, engineering or partnership interest. Write to Classified Ads, Dept. 176, 10700 Puritan Ave., Detroit 38, Mich.

available

SALES REPRESENTATIVE—Detroit area, for component jig and fixture parts. Established business. Write to Classified Ads, Dept. 178, 10700 Puritan Ave., Detroit 38, Mich.

TOOL ENGINEER—with manufacturing experience in metalworking for application and development of metalworking fluids. Experience in cutting fluids. Young mechanical engineering graduate preferred. Attractive growth potential with nationally recognized Eastern United States oil refiner expanding into new field of activity. State background, education, experience and salary requirements. Write to Classified Ads, Dept. 175, 10700 Puritan Ave., Detroit 38, Mich.

COLLEGE INSTRUCTOR—Engineering machine shop. Applicant should have bachelor's degree plus industrial experience. Please send resume to Dean of Engineering, California State Polytechnic College, Kellogg Campus, Pomona, Calif.

TOOL ENGINEER—Excellent future, salary open, position available in Jasper, Ind. Must be capable of coordinating tooling program to improve methods in the manufacture of carbide tooling. Write to Classified Ads, Dept. 177, 10700 Puritan Ave., Detroit 38, Mich.

Reports in Brief . . .

New England

MONADNOCK members heard D. W. Karger, head of the department of management and engineering at Rensselaer Polytechnic Institute, discuss patent fundamentals and what a company should know about handling new ideas, inventions and patents. The new officers installed at this March meeting were Walter Szacik, chairman; Walter Southmayd, first vice chairman; George Trask, second vice chairman; Russell Aldrich, secretary; and David Piper, treasurer.

South

A review and a new look at inspection techniques were presented at NASHVILLE's March meeting by W. T. Watts, president of the Bud Watts Machinery Co. Entitled "The Five Echelons of Inspection," the presentation offered explanations of production, inspection, gage laboratory, gage laboratory standards, and metrology laboratory.

Mid-Atlantic

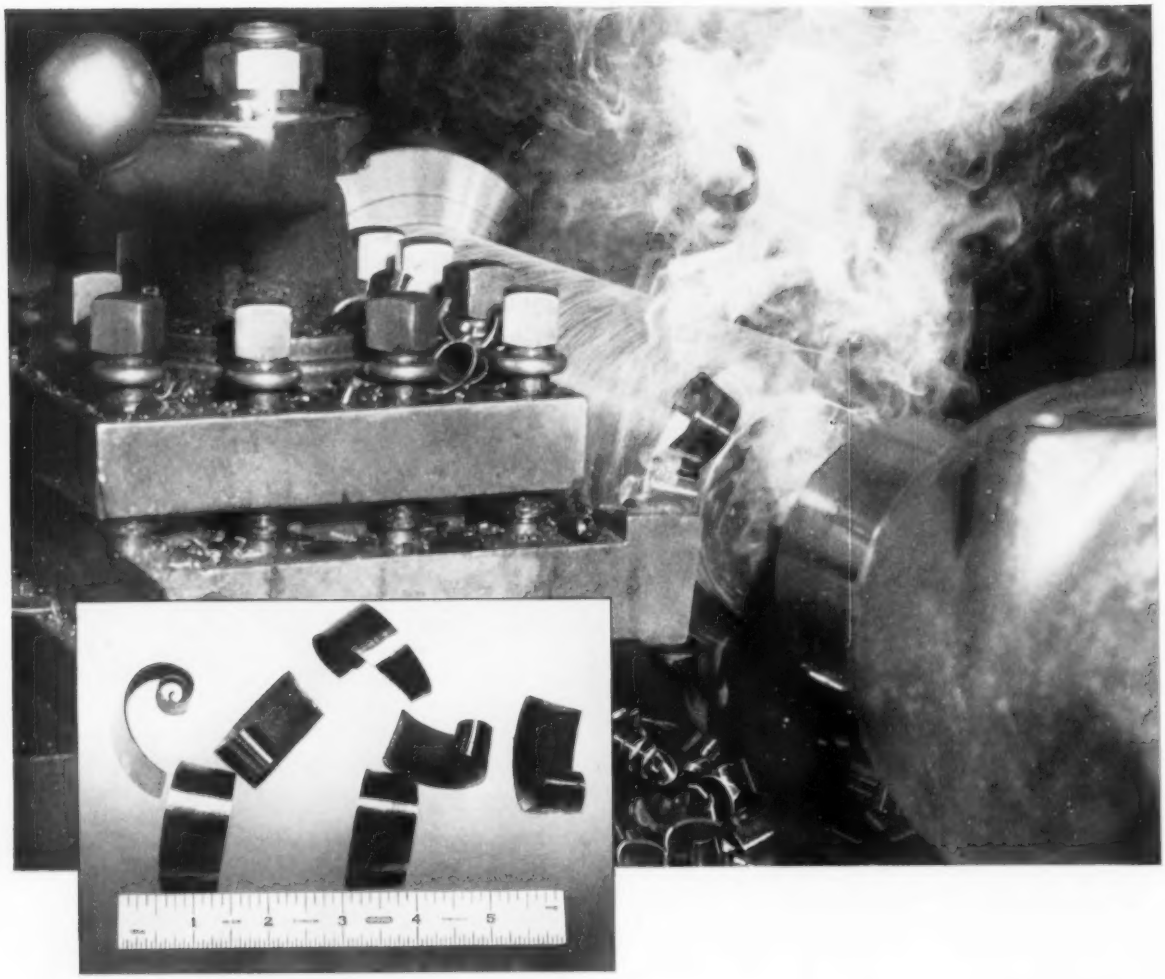
With five past chairmen in the audience, the new officers of the BALTIMORE chapter were installed at a recent meeting. Taking the oath of office from outgoing Chairman Robert Thomas were: Waldo Womeldorf, chairman; Joseph F. Radcliffe, Jr., first vice chairman; Glenn E. Borton, second vice chairman; Harry F. Byrne, third vice chairman; George Blume, secretary; and George Light, treasurer . . . . Standardization of processes, tooling and tooling components was covered in a talk by David C. French, Eclipse-Pioneer Div. of Bendix Aviation Corp., at PATERSON's April meeting. Proper stocking of parts, prepared forms and data sheets were a few things mentioned by French necessary for the success of an over-all standardization program . . . . Over 100 SYRACUSE members heard Robert E. Richards discuss "Steel Rule Dies" at their April gathering. The speaker is the chief engineer at the J. A. Richards Co. of Milwaukee.

Midwest

The advantages possessed by "Man-Made Diamonds" over natural ones were outlined by John W. Ripple, manager of diamond products at The Carborundum Co., and James T. Elovich, manager of diamond sales at General Electric Co., this March at a SOUTHERN MINNESOTA chapter meeting. One advantage the synthetic diamonds have is their ability to withstand a higher rate of feed without breaking loose from the wheel. This is due, the speakers said, to their irregular and more porous surface to which bond has a greater adherence . . . At a March meeting which featured a talk on cutting oils by H. W. Johnston of the industrial sales department at Standard Oil Co., the members of the LIMA chapter also saw the installation of their new officers. Heading the chapter's executive committee are Donald H. Cox, chairman; Wilbur E. Waters, first vice chairman; Wilbur A. Brillhart, second vice chairman; Burton C. Schwertfager, secretary; and James B. Walsh, Jr., treasurer.

West Coast

Some 35 students, members of the CALIFORNIA STATE POLYTECHNIC chapter, heard J. A. Isear, western region sales manager of the flame-plating department at Linde Co., at their March meeting. Isear's topic—"Plate It with Flame"—was illustrated by means of a display which showed the flame-plating process and its numerous applications, especially those concerned with space-age programs.



Chips like these boost machine output at HEWITT-ROBINS

The ability of VR-77 on heavy interrupted cuts gives Hewitt-Robins maximum machine output per dollar of machine investment. At their Robins Conveyors Division Plant in Passaic, New Jersey, VR-77 is used for maximum metal removal on 1045 cold rolled steel, taking a 0 to ⅞" cut at 300 s.f.p.m. with a .026" feed. Downtime has been cut in half because VR-77 removes twice as much metal per index as the previously used carbide brand.

Regardless of your particular machining problem, there's a V-R carbide specifically engineered to help you boost your machine output.

Send for Catalog VR-58 for complete details.

CREATING THE METALS THAT SHAPE THE FUTURE

V-R VASCOLOY-RAMET

812 MARKET STREET • WAUKEGAN, ILLINOIS

C-773

Progress in Production

SERVOCONTROL INCREASES SPAR MILL EFFICIENCY

An electrohydraulic servo system developed by Moog Servocontrols, Inc., has significantly increased efficiency and durability of wing spar milling equipment of two major aircraft manufacturers. Using the system in combination with a Farnham spar milling machine for rib-root milling on the "Thunderchief" F-105 fighter-bomber, Republic Aviation Corp., Farmingdale, N. Y.,

Spar mill equipped with electrohydraulic servo system. Template follower is seen at lower center suspended over template drum.

reports that the servo valve tracer makes it possible to use a cutting tool over the entire six-inch width of the rib-root cut.

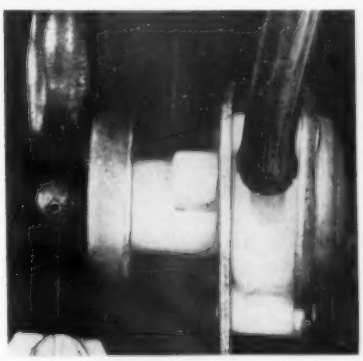
The outer contour of the rib-root forgings follows the shape of the wing, which is a compound angle. Responding to prepared cams, the tracer control mechanism tilts the head of the spar mill and controls the action of two separate cutters.

Formerly aircraft forgings of this type were machined by a setup on a vertical hydrotel milling machine. Because there was no angular variance possible, the compound angle was achieved by step tracing with small cutters, followed by a sanding or hand finishing operation.

At McDonnell Aircraft Corp., St. Louis, engineers report that a conventional servo type tracer system was replaced recently by the new method with excellent results. The new electrohydraulic system increased template movement by five to six times and greatly reduced template wear by providing a lighter, more accurate cam follower. Controlling a Farnham spar mill similar to that of Republic, the unit guides the axial rise and fall of each milling head with electronic feedback. This allows the separation of template and follower from the head to provide for convenient positioning during template change.

PLASTIC REPLACES DIE CASTINGS IN WASHER PUMPS

One of the first automotive parts made with du Pont's new plastic engineering material, "Delrin" acetal resin, is a tiny but efficient pump for the windshield washers on the 1960 Fords and Mercurys. The part, developed by the Delman Co. of Cookeville, Tenn., manufacturers of automobile windshield



Plastic windshield washer pump. Heat-resistant plastic shows strength and dimensional stability in the presence of water and corrosive fluids.

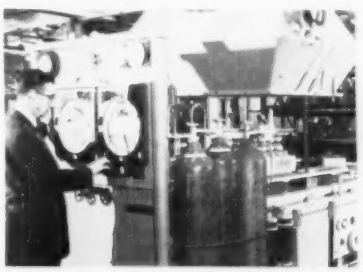
washers, is a gear type, vacuum-actuated unit driven off the fan belt.

Delrin is a tough, rigid thermoplastic, possessing an unusual combination of mechanical properties—strength, toughness and dimensional stability. It recently went into full-scale commercial production at du Pont's Washington Works, Parkersburg, W. Va., in natural color, weatherable black, and a line of standard colors.

Advantages of this plastic are its low weight and corrosion resistance. Lighter—and less expensive—than a similar die-cast part, it effectively eliminates internal corrosion which can cause plugging of spray nozzles and fittings.

IMPROVED HONEYCOMB BRAZING FURNACE

Impressive results from tests with a new "cold wall" brazing furnace have been announced at the Wichita, Kan., Div. of Boeing Airplane Co. The company's improved type furnace for the brazing of honeycomb structures has just emerged from extensive trials demonstrating its flexibility and adaptability. The unit was designed and tested by



Prototype cold wall brazing furnace has temperature control and recorder dials at one end of worktable. Tanks contain argon gas for purging oxygen.

the Manufacturing Research section at the Boeing facility in Wichita.

The new approach will help to give the company an important capability in brazing stainless steel honeycomb for high-speed vehicles of the future. Most of the honeycomb now in use is metal-bonded aluminum.

A prototype of the furnace was built some time ago in the metal bonding shop area. Since then, pilot runs have been made to test for ability to handle a wide variety of shapes and structures. The results show a high degree of flexibility and extremely rapid heating and cooling cycles.

Main features of the cold wall unit include placing the heating elements next to the structure being brazed, the addition of a cooling system and elim-

ination of costly metal envelopes for each part. The new furnace gets its name from the fact that its walls remain relatively cool during the brazing operation because of relocation of the heat source.

By adaptation of graphite tooling, insulation, and heating and cooling elements to appropriate configurations, honeycomb structures of varied contours can be brazed in the new furnace. These include corrugated or built-up types. The size and shape of the retort is adaptable to a wide range of configurations.

AUTOMATED LINE SPEEDS MANUFACTURE OF CONDUIT

Important advances in the steel industry's increasing use of automated equipment have been achieved by Youngstown Sheet and Tube Co. Long one of the nation's leading producers of conduit, the company has recently increased its production capacity more than 80 percent by the installation of a fully automatic conduit processing machine. The new processing line eliminates much handling time, reduces finishing time, bundles tubing automatically, and paints conduit both inside and out.

Designed and manufactured by Hanson-Van Winkle-Munning Co., Matawan, N. J., the 325-ft-long line cuts production time from five hours to less than one hour. In addition, the conduit emerges from the machine with a lustrous galvanized finish instead of the dull finish previously produced.

The installation has a maximum production capacity of more than 1200 10-ft units of ½-inch EMT (Electro Metallic Tubing) per hour. As the size of the tubing increases, finishing time is increased proportionately. While 20 units a minute are processed when the tubing diameter is ½ inch, for 2-inch tubing this rate falls to 10 pieces a minute.

MOVIE CAMERA MAGNIFIES TIME

A movie camera that can stretch the events of one second into 28 hours has been developed by Dr. Albert T. Ellis, associate professor of applied mechanics at California Institute of Technology. Originally designed for gas bubble photography, the camera combines optical, electronic and mechanical principles to take from 480 to 1,600,000 pictures per second on standard 35-mm film in black and white or color. Applications of the camera include the study of arc discharges, explosive reactions, fragmentation processes and high-frequency fatigue.

Because no mechanical shutter can approach the speeds required in this camera, an electro-optical shutter which controls light passage by means of electric pulses is used. When a high-energy electric pulse is applied, light is polarized in such a manner that it passes freely through filters. One or two optical lenses focus the image onto a rotating mirror in a film box.

The film remains stationary while the mirror revolves at the rate of 100,000 rpm. Placed at the center of the circular film box, the mirror directs light rays to the film so that images travel along the inside rim of the box. Speed of operation is determined by the speed at which the electric field is applied and removed.

Because intense illumination is needed to provide good resolution at high exposure rates, the camera is equipped with a special lighting system capable of producing 400,000 lumens with 3 milliseconds duration. The film magazine has a capacity of 400 feet of film, advance of the film being pushbutton controlled to allow automatic replenishment of the main camera chamber.

GIANT DIP TANK GOES INTO OPERATION

A dip tank said to be the world's largest tank for polyvinyl chloride dip coating of metal products has been installed by Quelcor, Inc., of Chester, Pa.

Dip tank in operation. Control of preheat temperature provides coatings of virtually any desired thickness.

Designed to handle single pieces up to six and a half feet in diameter and 20 feet long, the tank can apply single-layer coatings from 1/32 to ¼ inch thick. On light-gage metals, layers can be built up to virtually any desired thickness.

Operating in conjunction with batch or continuous preheating and curing ovens, the installation is able to handle many different large-size pieces or a large quantity of smaller similar parts on a continuous production basis. All coated equipment is spark tested to assure freedom from pinholes and voids.

TOOLS of today

Horizontal Rotary Table

Diameter of 102 inches and a bearing load capacity of 90,000 lb are features of this explosionproof, horizontal rotary table that has a certified accuracy of 5 seconds of an arc. Preliminary rotation positioning is achieved by a visible counter reading from 0 to 359 deg.

Final positioning is manual. A microscope provides minute and second adjustment to permit zeroing in on a precision-graduated band for positioning within 5 seconds of arc. The speed motor drive is adjustable from 0 to ⅛ rpm. or 108 ipm. High capacity cone worm gearing with positive backlash controls the de-energized self locking brake.

Machine Products Corp., 6771 E. McNichols, Detroit 12, Mich. **Circle 401**

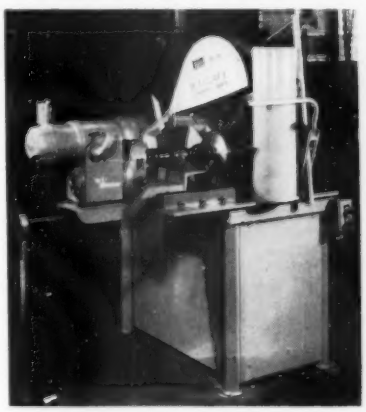
Conveyor Trolley Lubricator

Operated by remote controls from the floor level, a fully automatic, air-powered trolley lubricator assures correct lubrication of hard-to-reach trolley fittings, saves time and labor and increases operator safety by eliminating the need of climbing for lubrication service. The system consists of a right and left-hand lubricating assembly, a five-lb capacity lubricant reservoir mounted on a four-ft I-beam, and an electrically or pneumatically operated control panel. It is easily installed by cutting the beam and welding it in place. The unit delivers a predetermined, measured amount of up to 0.025 cu inches of lubricant per shot. A foldaway mechanism retracts the lubrication unit out of position if the conveyor system is not operating properly. The unit will service four-inch conveyor wheels traveling at a maximum speed of 75 fpm, with a minimum wheel spacing of 16 inches, or six trolley conveyor wheels traveling at a maximum speed of 60 fpm with a 24-inch minimum wheel spacing.

Aro Equipment Corp., Bryan, Ohio **Circle 402**

Abrasive Cutting Machine

The rotating chuck of this improved modular cutting unit lessens the area of contact, keeping the work cooler as it is cut, makes the cut more accurate and lengthens wheel life. The unit provides fast, accurate cutting of risers from foundry castings. Chuck capacity is 9 inches OD x ½-inch wall thickness stainless steel rings or 6-inch solids.

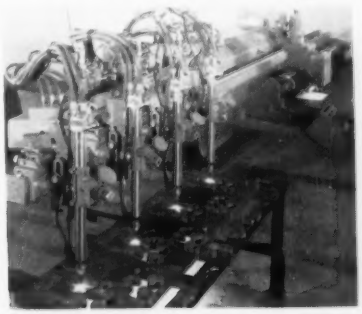


Casting risers are removed with 0.031-inch maximum corner radii of the cut-off surface. Chuck jaws are adjustable for ID or OD grip. The chuck is laterally adjustable for 0 to 6-inch clearance from the index position under the cutting wheel. This makes it possible to cut material that does not need to be chucked. Separate starting switches are provided for the chuck and cutting spindle drives. The unit utilizes a 16-inch abrasive wheel with a 10-hp, 3-phase, 60-cycle motor with variable speed rotator.

Wallace Supplies Mfg. Co., 1304 Diversey Parkway, Chicago 14, Ill. **Circle 403**

Shape-Cutting Machines

The "roller drive" principle of the Oxweld CM-56 machine completely removes the drive wheel from the template table. There is no force tending to shift the position of the line drawing, and drawings can be positioned without raising the tracing head. The



combined motion of the main and transverse rail carriages make it possible to follow and cut metal parts and forms of any shape. Either carriage can be locked to produce straight and accurate cuts parallel to the main rails. The machine is equipped with the company's Photocell Tracer with built-in kerf adjustment. The mechanism follows sketches on ordinary paper, completely eliminating the need for templates, photographic negatives or silhouettes. Tracing accuracy is ± 0.005 inch. The tracer can negotiate 90-deg turns with

1/16-inch radius at speeds up to 16 ipm. and 90-deg turns with 1/8-inch radius at speeds up to 27 ipm.

Linde Co., Div. of Union Carbide Corp., 270 Park Avenue, New York 17, N. Y. **Circle 404**

Numerically Controlled Drilling Machines

Drilling, tapping, reaming, boring and straight-line milling operations are fully controlled and programmed by a line of numerically controlled drilling machines. The units permit spindle speed, feed rate and depth settings to be controlled by both tape and dial, along with conventional X and Y coordinates.

Any combination of these three settings may be selected for any spindle at any time, permitting a given tool to be programmed to varying levels and varying depth of holes, all on the same workpiece. The machines eliminate use of jigs and fixtures and increases accuracy and speed of machining operations. Holes can be located and drilled to accuracies of 0.001 inch per foot, with production of up to 15 holes per minute on continuous, fully automatic operation.

Hillyer Corp., 331 Centennial Ave., Cranford, N. J. **Circle 405**

Butt Welding Unit

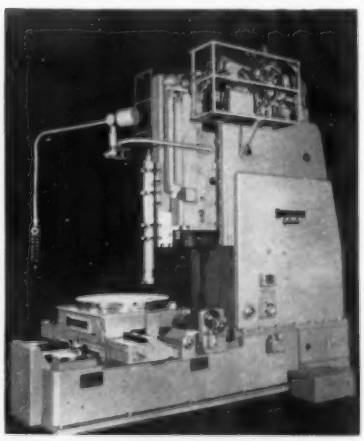
High production, speed and simplicity of operation are features of this heavy-duty butt welder. The automatic, air-operated machine accurately holds preset alignments. Clamping jaws are actuated by individual air cylinders to assure positive continuous clamping action. A third air cylinder operates and completely controls upset pressure and

degree of upset. A noncritical automatic welding actuator eliminates the use of critical air pressure switches. Clamps of the movable straightline jaw are set for material thickness, and welding can be started when the current control switch is set for the degree of heat required. The unit includes two air pressure regulators with individual gages and air line oilers, an air line filter and one set of clamping jaws and welding dies.

Peer, Inc., 1200 Milton St., Benton Harbor, Mich. **Circle 406**

Metalcutting Slotter

Flexibility and complete pendant-controlled operation of this machine provide savings in setup time. Model SM has a built-in dividing head for power indexing when cutting keyways, serrations and gear teeth. The 36-inch stroke vertical slotter is operated by pushbutton control. The pendant, operating through a range of 240 deg, provides selection for longitudinal,

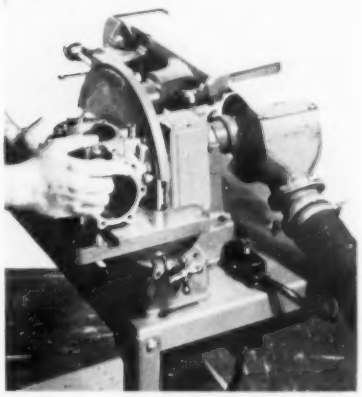


rotary and transverse motion. Two-speed traverse provides for change in stroke while the machine is operating.

Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill. **Circle 407**

Dual Finishing Machine

Ninety percent of all shop finishing operations can be done with this combination belt and disk finishing machine. The 4-inch abrasive belt and 12-inch abrasive disk will grind, surface or polish steel components, die castings, aluminum, brass and copper parts and other materials including wood and plastic. An idler drum guard facilitates

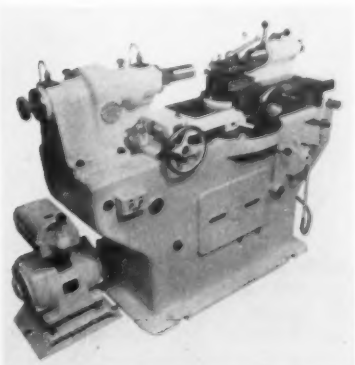


hollow grinding of wood and lathe chisels, carving tools and plane irons. An invertible platen provides for underside finishing or deburring; a removable end guard permits inside contour finishing on the idler drum; and the table gives ample support for finishing large patterns.

Walker-Turner Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa. **Circle 408**

Tool Lathe

Finishes of less than one microinch can be produced with this lathe that can be used with diamond, ceramic or carbide tools. Movement of the main-slide is 15 inches. Adjustable, antifriction, metal-lined, long steel bearings provide rigid support to the spindle, eliminating vibration and insuring accuracy. Capacity of the lathe is 8



inches; distance between centers is 28¼ inches; spindle speeds range from 250 to 2920 rpm; and automatic feeds are 0.001 to 0.005 ipr.

Milo Mfg. Co., 259 N. Broad St., Elizabeth, N. J. **Circle 409**

Diemaking Machines

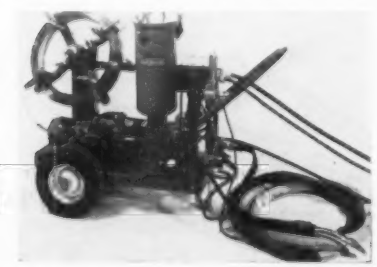
Filing, sawing and lapping can be done with a line of bench and floor model diemaking machines. All models provide infinitely variable strokes from 0 to 2 inches. The units are available with two, four and infinitely variable speeds from 100 to 475 spm. Strokes of the Model PDM, illustrated, are variable from 0 to 5 inches. Speeds vary

from 80 to 350 spm. Table tilt is 15 deg to the rear. Other models have four-way, 15-deg tilting tables.

Rice Pump & Machine Co., Belgium, Wis. **Circle 410**

Welding Equipment

High-quality welds at high speed and low cost are provided by equipment for CO_2 magnetic flux welding. The process utilizes inexpensive gas that acts as a shield around the welding arc and also carries a powdered flux to the torch nozzle. The welding wire is magnetically coated with the flux as it is fed into the arc. Steels up to ½ inch can be continuously welded in one pass without electrode change. A wheeled cart provides portability for the equipment, which includes a 12-inch diam coil of welding wire. The cart's curved handle pivots to a vertical position so that the machine can be lifted by crane or operated in a suspended position. Pistol or blowtype torches are available with the unit.



Linde Co., Div. of Union Carbide Corp., 30 E. 42nd St., New York 17, N. Y. **Circle 411**

Parts Cleaner

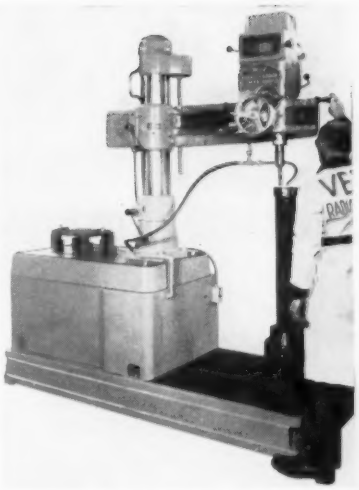
Small stamped and forged parts, in work loads of 300 to 1500 lb per hour, can be cleaned with this vertical, conveyor type washing machine. An 11-ft conveyor carries parts to the charging hopper. Work is received a few feet

above floor level and spray-cleaned as it moves upward to the point of discharge. Parts can be discharged at or near the ceiling level, or the conveyor can be extended to discharge the work on the floor above, thereby eliminating handling costs.

Ransohoff Co., Hamilton, Ohio. **Circle 412**

Radial Drill

Double-end, two-level radial drills permit one operator to set up large workpieces—up to 62 inches under the spindle—on the low base, while a second operator drills smaller work on the work-height table at the opposite end.



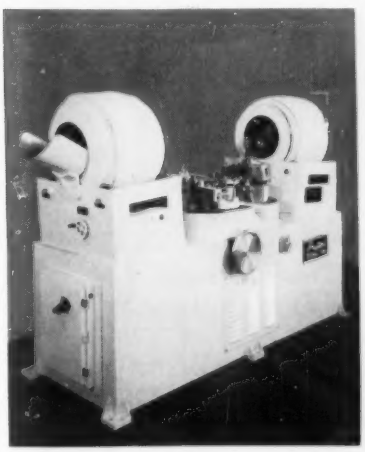
A new cast X-member supports the heaviest loads. The cabinet base provides easily accessible storage space for tooling and accessories. A drill rack, built into the door, holds a full set of taper shank drills from ½ to 1¼ inches by sixteenths.

Veet Industries, 25653 Groesbeck Hwy., E. Detroit, Mich. **Circle 413**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Thread Rolling Machine

Two hoppers in this unit provide for the running of two different blank stock lengths simultaneously, at production speeds of 600 to 800 pieces per minute. All work is class 3 fit. The model 125A-24 planetary thread rolling unit can

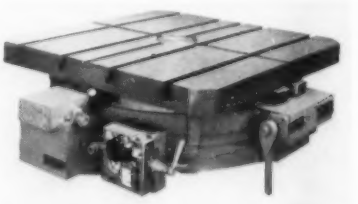


roll screws, bolts and nails. It will also roll form, knurl, mark, serrate and neck. The machine handles over-all blank stock lengths up to three inches in length and diameters up to 5/16 inch.

Prutton Corp., 5295 W. 130th St., Cleveland 30, Ohio. **Circle 414**

Rotary Tables

Indexing of extra-heavy loads, even when placed off-center, can be done with a line of rotary tables in round or square shapes and sizes from 36 inches. When the tables are indexed, an air-oil mist lifts the top through valves in the way surface of the base, "floating" the top on about 0.001-inch

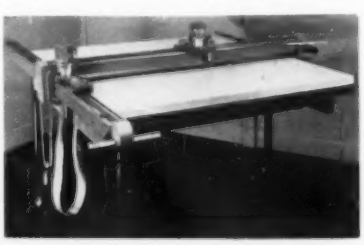


of mist. Lift is automatically distributed, providing constant support for an offset load. The tables can be used with horizontal boring mills and milling planers, and can be furnished on runways for use with floor type mills.

The Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio. **Circle 415**

Automated Plotter

Precise layout of grid systems and coordinate positions can be done with this instrument that is operable with punched tape or cards. Maximum operating speed is 3 ips. Slowest speed is 0.003 ips. Encoder resolution is to 0.001 inch. The unit's static, directly coupled system retains a constant zero reference. The unit can be used for layout of templates, charts and printed circuits.



The instrument's visual readout and control unit provides a projection type display of digital information. The same unit carries controls for input and printout. A Flexowriter unit provides a keyboard for entering data, a punch to prepare tape for automatic plotting, a tape reader to enter information, and an electric typewriter to produce a printed record and verification of the tape punching.

Aero Service Corp., 210 E. Courtland St., Philadelphia 20, Pa. **Circle 416**

Self-Propelled, Trackless Carriage

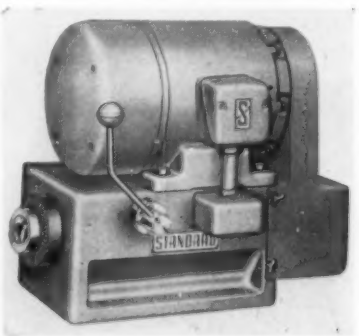
Designed to produce long welds continuously, thereby increasing the operating factor, this 37-lb compact tractor requires no supporting fixture. It supports, advances and guides the welding gun along the joint, producing fully

automatic submerged arc welds. Magnetized rollers move the unit at speeds of from 7 to 70 ipm. It will travel on either flat surfaces or those inclined within the practical limits of the submerged arc process. Adjustment of the gun support permits various types of welds.

The Lincoln Electric Co., Cleveland 17, Ohio. **Circle 417**

Bench Lathe

Continuous heavy duty service on secondary operations such as polishing, burnishing, lapping, spinning, reaming, and filing of small parts is provided by this belted motor-driven speed lathe. Spindle speeds range from 180 to 3600 rpm. The unit is operable at one speed or with two or four-speed combinations.

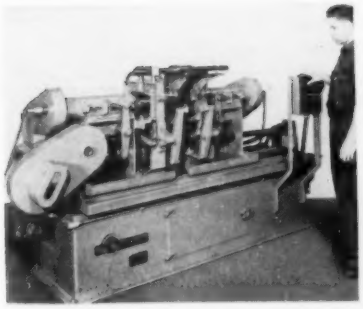


The shaft has a one-inch diam through-hole. The spindle nose accommodates No. 5C draw-in collets up to one-inch diam round, $\frac{7}{8}$ inch hex and $\frac{3}{4}$ inch square. The lathe is hand-operated. Accessory equipment is available.

The Standard Electrical Tool Co., 2488 River Rd., Cincinnati 4, Ohio. **Circle 418**

Deburring Machine

Automatic chamfering of the ID, OD and face of tubular steel parts with from

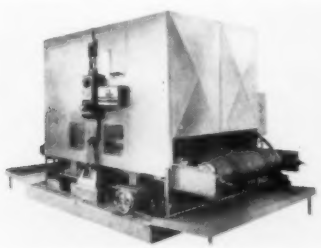


¾ to 2½-inch diam and from 2½ to 24 inches in length is done with this automatic, double-end deburring machine at production rates of up to 6000 pieces per hour. Fixtures are designed to permit rapid tool change from one tube diameter to another. No changes are required for tube length variations within a given tube diameter. Tubes are manually loaded into a vertical magazine, and successive operations are entirely automatic and synchronized by a variable speed program shaft. .

Acme Mfg. Co., 1400 E. Nine Mile Rd., Detroit 20, Mich. **Circle 419**

Abrasive Grinder

Thickness tolerances of ±0.001 inch can be held on this conveyorized, abrasive belt grinding machine with a diamond-shaped head that flexes the belt as it drives. The No. 458 machine can be used for high-production finishing of honeycomb, sheet stock, small parts such as motor laminations and for other flat work requiring critical thickness tolerances. The grinder accommodates a 36, 48, 60 or 72-inch

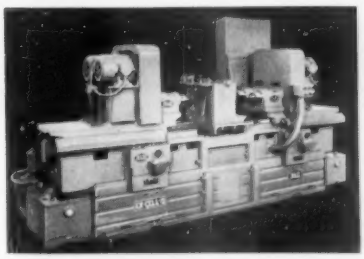


belt. Automatic upfeed increments of from 0.0002 to 0.0005 inch per impulse are available to compensate for belt wear or partpiece size. Gaging and depth setting are manual. A variable speed drive provides a minimum speed of 6 fpm and a maximum speed of 60 fpm. The unit can be supplied with a single head for reciprocal or single-pass grinding, or with multiple heads and straight-through conveyor.

Mattison Machine Works, Rockford, Ill. **Circle 420**

Boring Machine

Crankshaft and camshaft bearing diameters of four-cycle gasoline engines are bored with this machine. The manually loaded, aluminum alloy, right and left-hand workpieces are interchange-



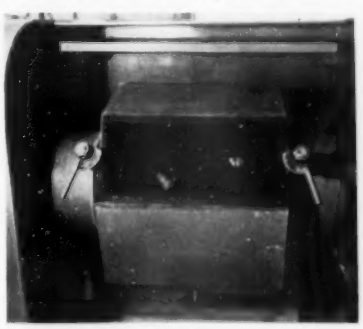
ably accommodated by the fixture. Spindles mounted in the left side bore the camshaft hole, face the boss and chamfer. Hole diameter tolerance is within 0.0005 inch. The crankshaft bearing diameter is bored, counterbored and chamfered from spindles mounted in the right slide, and hole diameter tolerance is within 0.0003 inch. Total time, including load and unload, is 27 seconds and gross production rate is 266 parts per hour.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. **Circle 421**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Barrel Finishing Machines

Smaller models of the Vibraslide barrel finishing machine offer vibration without rotation and fast, fine finishing. Economy in initial price, media inventories and finishing time are provided where there is a wide variety of items to be finished in relatively small numbers. With the new models, which are 5 and 10 cu ft in size, speed of finish is



increased because of greater amplitudes in vibration. Even when the barrel is not rotating (illustrated, with door removed), workpieces are rotated through high-frequency vibration.

Minnesota Mining & Mfg. Co., 900 Bush Ave., St. Paul 6, Minn. **Circle 422**

Packaging for Adhesives

Small plastic containers, each holding a premetered quantity of both epoxy adhesive and catalyst, simplify the mixing of small quantities of these materials. The packages act as combination dispensing and mixing containers and eliminate the need for frequent mixing of new batches of the rapidly cured adhesives. Inspection of bonded parts is simplified, since the two components included in each throwaway package are colored in contrasting shades, such as yellow and red or yellow and blue, and must be mixed until a uniform color has been obtained. Bonding agents offered in the packaging include PA-708, a metal-to-metal adhesive; PA-815, for bonding glass or ceramice surfaces; and PA-746, for use with treated Teflon.

Plastic Associates, 2900 S. Coast Blvd., Laguna Beach, Calif. **Circle 423**

Head Screw Counterbores

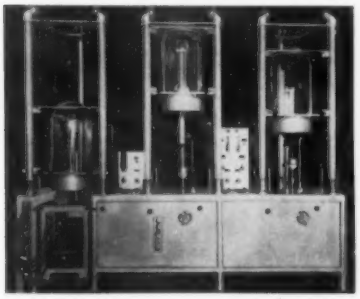
No. 1B standard toolroom set contains counterbores to suit screw heads No. 6 through 5/8-inch diam with necessary pilots and holders. Countersinks for 60, 82 and 90-deg included angles are also provided. The 1960 standard for socket head screws makes most head diameters larger than those of previous models, making it possible for the screws to carry greater loads without indenting materials being fastened. The toolroom set illustrated is fabricated for use with screws of this new standard.

Continental Tool Works Div., Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. **Circle 424**

Induction Heating Fixture

Brazing metal assemblies by induction heating under a controlled atmosphere can be done with this production fixture. The reducing atmosphere prevents oxidation on the work during heating and eliminates the need for flux. Joints produced with this method are uniformly sound and free of residual or entrapped flux, insuring parts that are corrosion-resistant and strong in critically stressed inaccessible parts. The unit illustrated has two fixed working stations and one caster-mounted heating station.

The fixture provides for rapid change-over from one job to another through quickly interchangeable units. The bell jar fixtures can be made in any combination of fixed and removable stations.



The three work stations are operated from a single induction heating generator, and the heating cycle is automatically controlled at each station by a preset timer.

Lepel High Frequency Laboratories, Inc., 55th St. and 37th Ave., Woodside, N. Y. **Circle 425**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Heavy-Duty Routers

Straight or contour cutting of wood, metal, plastic and honeycomb can be done with the 61R series of heavy-duty, air-powered routers. Range in capacity is ¼ to ½-inch collet. Speed range is 6000 to 15,000 rpm. Features include precise depth-of-cut adjustment,

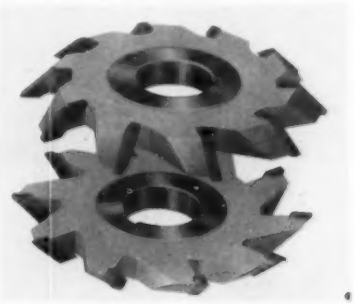
self-cleaning operation, large front-end bearing to take radial and thrust cutting forces, full-grip collet and thumb-flip throttle. The unit is available with a maneuverable base for portable use or without base for fixture mounting.

Buckeye Tools Corp., 5003 Springboro Pike, Dayton 1, Ohio. **Circle 426**

TOOLS of today

Angular Cutter

Angular grooves and dovetails can be milled with this carbide tipped, 45-deg angular cutter, available in Series 200 for steel and Series 300 for cast iron, bronze, brass and other nonferrous



metals. The tips facilitate regrinding without grinding steel cutter body. Designed for use on arbor, the teeth have 0-deg rake and the cutter may be had with keyway in line with teeth or halfway between teeth. Chamfer on OD is $\frac{1}{64}$ inch maximum and tolerances are ± 0.015 on cutter diam and width.

Cutting Tool Div., Browne & Sharpe Mfg. Co., Providence 1, R. I. **Circle 427**

Rotary Chuck

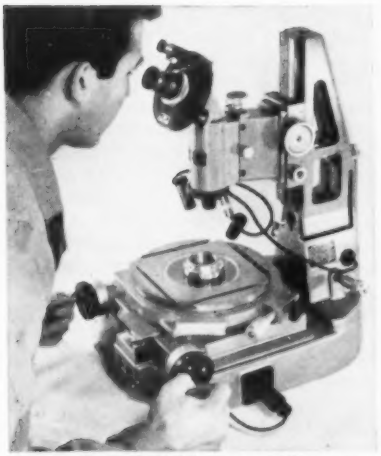
Magnetic power of this permanent ceramic chuck is sufficient to allow the tool to be safely used for lathe work as well as grinding. A special lock insures positive magnetic holding under the most rapid start-and-stop conditions.

Variable holding power allows easy work positioning. The chuck has an all-steel top plate and no electrical accessories are needed.

O. S. Walker Co., Inc., Worcester, Mass. **Circle 428**

Structural Film Adhesives

Four high-strength film adhesives—AF-10, AF-30, AF-31 and AF-32—offer



Gaertner Toolmakers' Microscope used to measure typical piece part. Co-ordinate range 4" x 2".

Precise measurement to 0.0001" and 1 min. of arc

Gaertner Toolmakers' Microscope

Here is a reliable, easy-to-use microscope for precise measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. Ideally suited for making a wide variety of precision measurements and is especially valuable in reducing rejects in production work.

With the Gaertner Toolmakers' Microscope you make direct, non-destructive measurements — no contact, no distortion, images are sharp and clear. It is a basic measuring instrument for inspection depts., gage labs, tool and die and model shops, industrial and research labs.

The Gaertner Toolmakers' Microscope has been proven in use by U. S. Government Gage Laboratories, and by prime contractors and their subcontractors. With all parties using the same measuring instrument, inspection procedures are co-ordinated and disagreements and rejects minimized.

Features that help you get
HIGH SETTING AND REPEATING ACCURACY

- Low, compact built-in rotary stage reads to 1 minute of arc throughout 360° range.
- Minimum overhang of stages.
- Full 2" precision-lapped lead screws with correction device.
- Straightforward, direct, uncomplicated optical system.

Features that assure you of
EASY, CONVENIENT OPERATION

- Independently rotatable cross hairs in protractor ocular speed up measurements, simplify measuring procedure.
- Convenient location of ocular eyepieces for ease of reading.
- Built-in transformer and plugs for all illuminators.

Modifications and accessories to
MEET YOUR EXACT REQUIREMENTS

- Thread and radius templates, camera and spotting attachments, fine motion focus, variable magnification available.
- If you have a special measuring problem, our staff of representatives will be happy to consult with you. The service and engineering facilities of the manufacturer are always immediately available to help you.

Write for Bulletin 147-56

Designed and manufactured by

The Gaertner Scientific Corporation

1241 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335
Use Reader Service Card, CIRCLE 70

design and cost-saving advantages for bonding metal and plastic structural assemblies. They provide uniform adhesive thickness throughout the joint, controlled confinement of adhesive to the immediate bonding area, clean bonding operations and simple application procedures. The dry bonding adhesives are available in varying widths and thicknesses and can be die cut into desired shapes. Shear strengths range from 3040 to 4180 psi. Peel strengths range from 55 to 110 lb per inch width at 75 F service temperature.

Adhesives, Coatings and Sealers Div., Minnesota Mining and Mfg. Co. **Circle 429**

Mist Coolant Generator

Designed for use on drill presses having 2¾-inch columns, Model D-60 generator automatically controls air and coolant by the up and down movement

of the press spindle. Attachment of the tank to the column permits operator freedom and greater press work capacity.

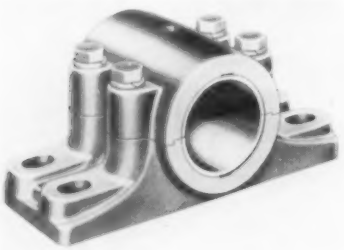
Aetna Mfg. Co., 199 S. York St., Bensenville, Ill. **Circle 430**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Bronze-Bushed Pillow Blocks

Recommended for applications where shock loads, elevated temperatures and corrosive conditions are anticipated, a line of sleeve bearings make it possible to replace worn bushings or liners in pillow blocks without removing the bottom half of the housing from its support. Replacement is accomplished by removing the cap of the block, lifting the shaft enough to permit the lower half of the liner to be loosened and slipped out, and inserting and seating a new liner by tapping lightly. The cap liner is easily replaced. Rotation of the liner with the shaft is prevented by a brass retainer spool recessed between the cap and base of the housing.

Use Reader Service Card, CIRCLE 71



The bronze-bushed line includes two-bolt journal bearings for standard power transmission shaft sizes from $1\frac{15}{16}$ to $2\frac{15}{16}$ inches; rigid, four-bolt pillow blocks for shafts from $3\frac{1}{16}$ to 8 inches; and angle pillow blocks for all standard transmission shafts.

Dodge Mfg. Corp., Mishawaka, Ind. **Circle 431**

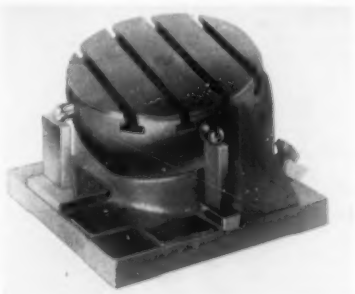
High-Speed Splice Welder

Twelve to fifteen welds per second, compared to one weld per second with comparable hand units, can be produced with a splice welder developed for high-speed precision splicing of structurally critical honeycomb core materials. Except for one premium quality electron tube, the unit is composed entirely of transistors and other solid state devices. Solenoid valve life is estimated at over 10 million operations. The welder has a power-operated tweezer head, solenoid valve, air pressure regulators, tweezer head support beam, cables and connectors. Normal heat setting, welding frequency and interval setting are adjustable. The unit will provide node welds in materials with thicknesses of from 0.001 to 0.010 inch. Electrical requirements are 230 volts, 60-cycle single phase current that can supply peaks of 50 amps and an average current of 15 amps. Air pressure required is 80 psi, 1 cfm.

Hexcel Products, Inc., 2332 Fourth St., Berkeley, Calif. **Circle 432**

Compound Angle Sine Table

Available in 9, 13, 18, 26 and 36-inch diam, this table is accurate to within 10 seconds of arc and is of particular value for the inspection of jigs and gages and in the manufacture of components on grinding and jig boring



machines. The unit permits any angle up to 45 deg to be set as a single or compound angle. Sine settings are obtained by the insertion of gage blocks under two ball-ended pins spaced 90 deg apart. Gage blocks are removed and the table is locked after the settings are completed. The table can also be used with the manufacturer's auto-collimator and angle gage blocks for optical settings of angles.

Div. of Engineering and Scientific Instrumentation, Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. **Circle 433**

Midget Cylinders

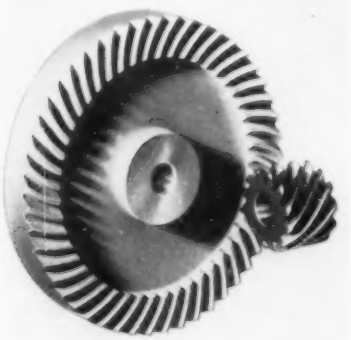
Advantages of block V-sealing and greater bearing length are combined in a line of air and hydraulic cylinders

that have two packings on the piston and one on the rod gland. Reduced piston rod end diameters permit field replacement of rod gland packers without damaging the O-ring end cover seals or rod end threads. Bores of the cylinders are ¾, 1 and 1⅛ inch. Lengths are in one-inch increments, with fractional increments available on request. Series Mark A operates at 200 psi air pressure or 750 psi oil pressure, and Series Mark H operates at 2000 psi oil pressure. Available in 10 heavy-duty mounting styles, the cylinders are continuously operable at ambient temperatures of 40 to 180 F, and intermittently operable at temperatures up to 200 F.

Control Line Equipment, 19560 Center Ridge Rd., Cleveland 16, Ohio. **Circle 434**

Face Gears

Depending on size and application, skew-axis gears applicable through a ratio range from 3:1 to 400:1 can be hobbed, cast of metal or plastic or



compacted of sintered metal. The pinions can be rolled, milled, chased or, on higher numbers of teeth, can be hobbed. The face gear system is low in cost but maintains a high degree of insensitivity to mounting errors.

Spiroid Div., Illinois Tool Works, 2501 N. Keeler Ave., Chicago 39, Ill. **Circle 435**

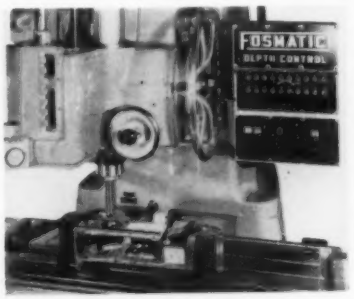
USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Boring Control

Numerical depth control for boring machines provides accuracy to ±0.0001 inch in small lot boring jobs. Use of the manufacturer's control-equipped Models 44 and 55 in production work eliminates the need for jigs and fixtures on many jobs. Programming is accurate if tool length to the nearest ½ inch is known. Tool compensation requires

TOOLS of today

about one minute per tool and is performed only once, to a zero reference. A tool compensator is mounted on the

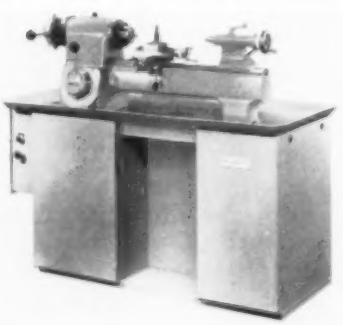


machine head. The same system is used to adjust for tool wear. Manual depth setting can be done through a series of direct reading dials that automatically stack the gages. Whether under manual pushbutton or tape control, the tool in a boring machine equipped with numerical depth control moves at a rapid approach rate to within 0.050 inch of the work surface, then changes automatically to the required feed rate.

The Fosdick Machine Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio. **Circle 436**

High-Speed Lathe

In the Sixty Series of high-speed, precision lathes, a single lever starts the spindle and selects any speed within the range up to 4800 rpm. The same lever will change speeds during operation, or stop or reverse the spindle.

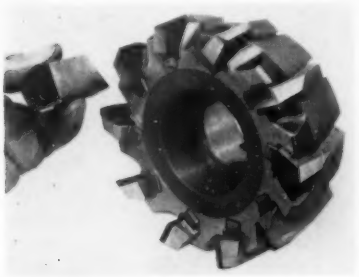


Stops may be set for repeating selected speeds on duplicate work. The double-bevel bed positively centers the tailstock in alignment with the headstock. The large bearing area prevents below-center wear. Constant bearing preload, unchanged by speed or heat, holds the spindle rigid against both side and end pressure of the cutting tool.

Rivett, Inc., Brighton 35, Mass. **Circle 437**

Milling Cutter Blades

Used in milling cutters for machining cast iron, aluminum, magnesium and steel, Series 7888 blade life is automatically increased 36 percent because seventeen 0.030-inch regrinds are possible on each blade, compared to an



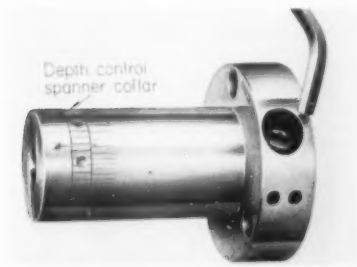
average of 12 regrinds with blades of former design. Blades are available for either right or left-hand cutters with diameters of from 4 to 32 inches. The brazed carbide blades will be supplied on all of the manufacturer's new Series 5200, 5400 and 5500 milling cutters and can be used without change on existing cutters in these series.

Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich. **Circle 438**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Boring Quills

Control of hole size, without loosening or tightening screws, can be accomplished with infinitely adjustable precision boring quills. The units also permit incorporating of an integrally operated depth-control adjustment when required. Hex-key adjustments of less



than $\frac{1}{10,000}$ inch can be made to compensate for tool wear on ultrafine tolerance boring jobs. Railing bearings in an eccentric mounting within the boring quill allow for this adjustment, eliminating the former need for turning of the bearing bushing with a spanner wrench. Positive drive to the boring bar is provided by the worm gear hookup, and there is no backlash or slippage.

Briney Mfg. Co., 1165 Seba Rd., Pontiac, Mich. **Circle 439**

TOOLS of today

Magnetic Crack Detector

Capable of detecting subsurface as well as surface cracks, flaws or defects in any ferromagnetic metal, this portable unit develops a powerful, penetrating d-c magnetic field. It can be operated from any 110-volt, a-c source. The

detector unit includes probe, connectors, sprinkling bulbs, gray and yellow powder and a steel carrying case.

United States Casting Repair Corp., 6432 Edmund St., Philadelphia 35, Pa. **Circle 440**

Test Materials

Magnetic particle inspection materials, available in pressurized spray cans and plastic squeeze bottles, can be used with any inspection equipment or test

kits. Parts of complex shape being tested on large wet type units can be quickly and easily inspected. Both bath and powder materials are packaged in the dispensers.

Magnaflux Corp., 7300 W. Lawrence Ave., Chicago 31, Ill. **Circle 441**

Microminiature Rivets

Fasteners for subminiature electronic and instrument applications are designed for ease of installation in the fabrication of extremely small assemblies. Head form of the rivets is a modified brazier with low contour and minimum functional diameter for the stresses imposed. Design of the units combines advantages of both solid and tubular rivet styles in a concentrically deep drilled shank. The rivets are made

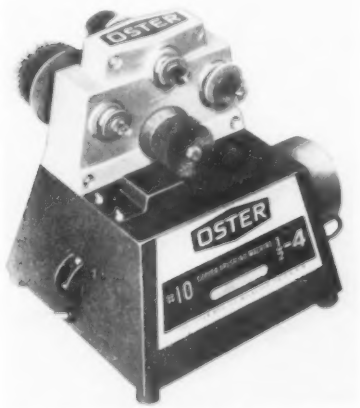
of nonmagnetic brass and finish is electroplated and shot-burnished 24 carat gold that provides good electrical contact and soldering characteristics. A full line of lengths is available in fractional increments of 1/32 inch in each fractional diameter down to and including 1/32 inch. Forty small sizes are available as standard.

Circon Component Corp., Santa Barbara Municipal Airport, Coleta, Calif. **Circle 442**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Copper Brushing Machine

Designed to clean copper tubes and fittings, even on small installations, the No. 10 copper brushing machine cleans the ID of fittings and deburrs and cleans the OD of tubing by power. The one-man unit eliminates hand operations. Capacity of the unit is 1/2 through 4 inches. Oscillating motion of the six



spindles provides quick and efficient cleaning of six different size fittings without changing brushes. Tubing is cleaned by a rotating steel brush on the side of the machine. Directly behind the brush, a rotating file deburrs the end of the tubing. An accessory reaming tool for tubing sizes up to two inches is interchangeable on any spindle.

The Oster Mfg. Co., 1340 W. 289th St., Wickliffe, Ohio. **Circle 443**

TOOLS of today

Tapping Spindles

Lead-screw tapping spindles, with the same sleeve diam as standard slip spindles, have nose cone OD sizes of from $\frac{7}{8}$ to 3 inches. The tools are compact

in design with accurate leads for cutting uniform threads. They can be used on machines arranged for drilling and tapping operations and equipped with jig-bored cluster plates. Extra plates are not required.

Siebert and Sons, Inc., Chenoa, Ill. **Circle 444**

Mechanical Feed Drills

Clean, precisely-located holes drilled with this unit seldom require reaming, even in tough materials. There is no plunging on breakthrough, and constant feed decreases the amount of burr at the hole rim. An air motor powers the positive feed mechanism. The twist

drill is automatically fed into the material at a predetermined rate until a preset depth is reached. Rates of feed obtainable are 2, 3, 4, 6 and 8-thousandths inch per twist drill revolution. Drills are available in 12 speeds, from 450 to 4500 rpm, with two power ranges, straight or offset handles, and 0 to $\frac{5}{16}$-inch drill chuck capacity. Forward travel and quick return are adjustable fom 0 to $1\frac{1}{4}$ inch.

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y. **Circle 445**

Toggle Clamps

Miniaturized, vertical-handle toggle clamps have a holding pressure of 100 lb. Model 102 has a straight vertical

handle and 102T has a T-shaped handle. Both are available with an optional straight base. Base hole center distances are spaced for aircraft and electric pegboard assembly fixtures. Series 105 toggle clamps have an improved base design that gives a stronger clamp, with holding pressure up to 42 lb, and slotted mounting holes to simplify final adjustments. Clamps of this series are available with either solid or U-shaped workholding bars. Four different bases are available.

Detroit Stamping Co., 340 Midland Ave., Detroit 3, Mich. **Circle 446**

Dust Collecting Bench

Fan and filter compartment of this dust collecting bench is separate from the grating work surface, but connected by a duct 12-inches high. Downtime for repositioning the work is eliminated

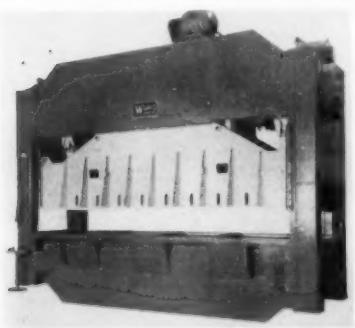
since the operator can work from all sides of the unit. A 12-inch platform can be added to the other three sides of the work area, providing access from all sides at the same level.

Wolverine Equipment Co., 31 Main St., Cambridge 42, Mass. **Circle 435**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Piercing, Blanking Press

Originally designed for piercing and blanking of aluminum parts, this welded-steel press provides high rigidity and frame strength. It has a capacity

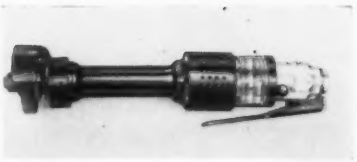


near bottom of the stroke of 500 tons. Features of the machine include double back, geared twin drive and straight side piercing and blanking. Distance between housings to clear is 240 inches. Area of the slide is 72 x 240 inches, with a stroke of 12 inches. The press operates at 30 spm.

The Federal Machine and Welder Co., Warren, Ohio. **Circle 447**

Horizontal Grinders

Two general purpose horizontal



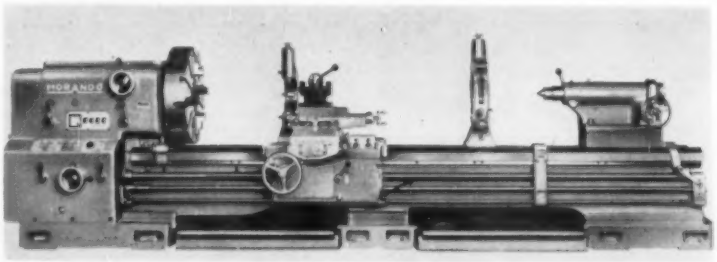
grinders, 10 inches long and weighing 40 oz, are principally designed for die grinding. The small, air-powered tools are suited for deep hole grinding and are adaptable for use with rotary files, cutters and midget mills. Both tools operate at 20,000 rpm; require ¼-inch

ID hose and 90 to 100-psi pressure; have $^{5}/_{16}$-inch OD front heads; and will accept a maximum of $1^{3}/_{4}$-inch organic wheel. The 31G-520 model, illustrated, has a lever type throttle and the 31G-720 is equipped with a lockbutton throttle. Collets, extension spindles and a spindle adapter are supplied with both models.

Buckeye Tools Corp., 5003 Springboro Pike, Dayton 1, Ohio. **Circle 448**

Heavy-Duty Lathes

Available in 50, 75 and 100-hp main driving motors, a line of heavy-duty lathes have a swing of 150 inches and centers of various lengths. The Moran-

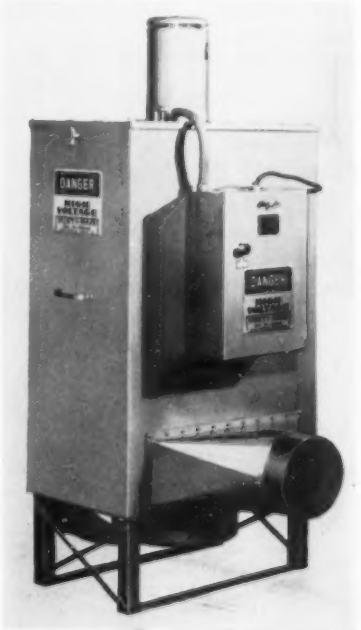


do units, of building block construction, are completely interchangeable. They provide a wide range of feeds and speeds; inserted ways that are hardened and ground; helical-drive gear and all-geared head-stock. Centralized controls simplify operation of the head. Double cross slide saddles are independently controlled, and control of the three-stroke travel and working motions is independent. A variety of special equipment is available.

S & S Machinery Co., 140 53rd St., Brooklyn 32, N. Y. **Circle 449**

Mist Precipitator

Objectionable pollution, such as oil mist, smoke and fumes, can be removed from shop air with this compact, self-contained electronic unit that contains a blower, filter and electrostatic precipitator. Air exhausted from the unit is returned to the shop, reducing heating



and air conditioning costs. A simple ductwork to the machine tool or welding booth collects polluted air from those operations. The only other installation requirements are an electric power connection and drain. The unit is available in sizes rated at 600 or 1200 cu ft per minute.

Air-Maze Corp., 25000 Miles Rd., Cleveland 28, Ohio. **Circle 450**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Air-Hydraulic Boosters

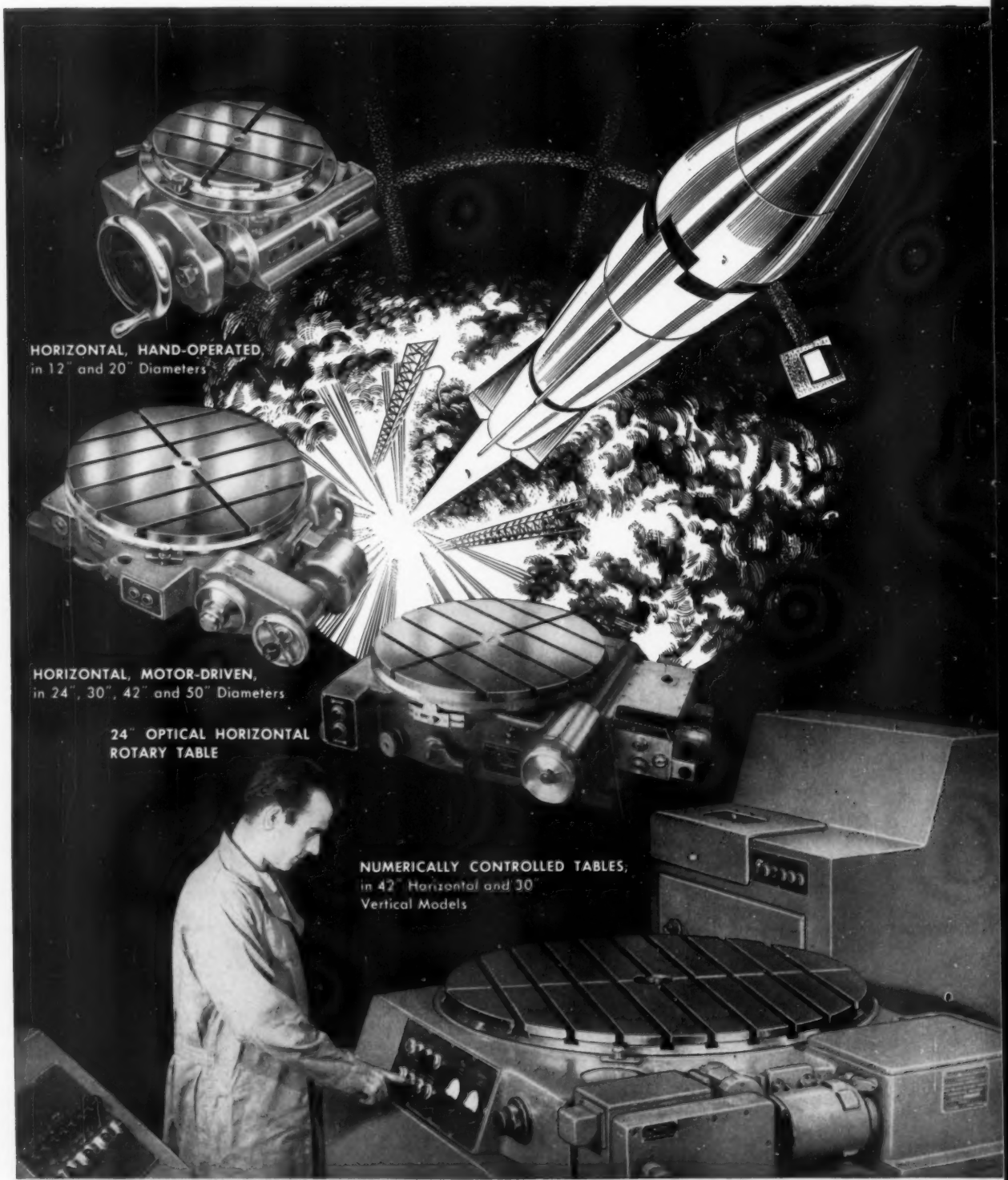
Ordinary compressed air (80 psi) can be boosted up to 3000 psi hydraulic pressure without use of any additional power or need for pumps or motors by a line of air-hydraulic boosters. Space-saving design of the units permits their use for powering such equipment as spot welders, C-frame riveters, hydrostatic testing equipment, workholding fixtures and bench or arbor presses.

Seal effectiveness of the boosters increases in proportion to pressure increase. In fluid systems, the units can be used with petroleum-base oils and water-base fire-resistant fluids. The air-to-oil booster illustrated has an integrally mounted tank that eliminates or reduces customer-furnished piping.

S-P Mfg. Corp., 30201 Aurora Rd., Cleveland 39, Ohio. **Circle 451**

(Continued on page 170)

ACCURACY


HORIZONTAL, HAND-OPERATED,
in 12" and 20" Diameters
HORIZONTAL, MOTOR-DRIVEN,
in 24", 30", 42" and 50" Diameters
24" OPTICAL HORIZONTAL
ROTARY TABLE
NUMERICALLY CONTROLLED TABLES,
in 42" Horizontal and 30"
Vertical Models

ASSURED...

Where pin-point precision is essential!
PRATT & WHITNEY Precision ROTARY TABLES

In the spacecraft and missile field . . . and in a very wide range of other applications throughout industry, Pratt & Whitney Precision Rotary Tables are first choice wherever the ultimate in dependable accuracy for circular spacing and angular position is a must! Playing an important part in America's space-missile program, P&W Rotary Tables are used for machining, calibrating and testing in the construction of the missiles. They are also used for the extremely critical job of aiming the missiles for firing. Accurate to 2 seconds of arc, the tables used for aiming are equipped with optical attachments and are employed as azimuth indicators.

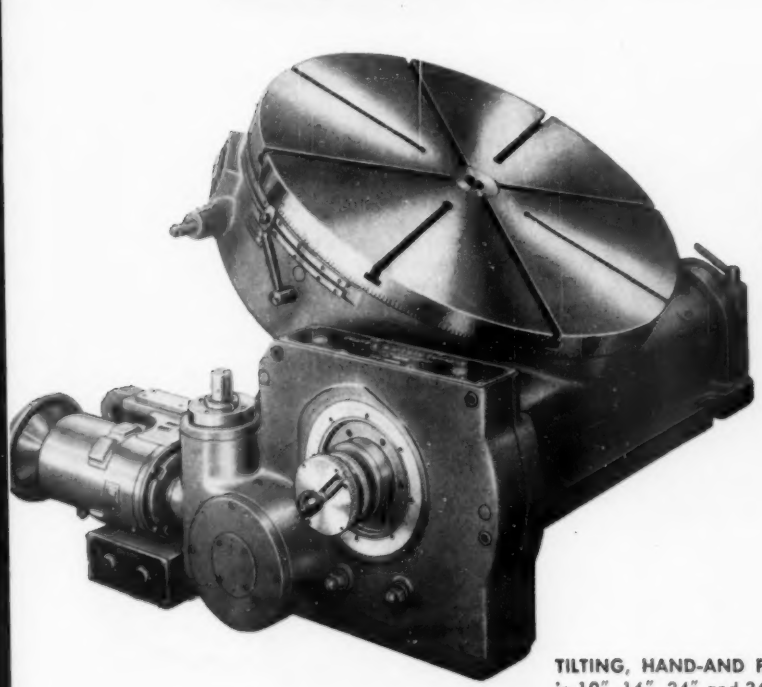
Providing the right type and size for every requirement, only Pratt & Whitney offers a truly complete line of *precision* tables. As shown on these pages, Horizontal, Vertical, and Tilting types, in Hand-Operated and Motor-Driven models, are supplied in 12″ to 50″ diameters. Optical, Automatic Indexing, and Numerically Controlled types are also produced. Certified accuracies as high as 2 seconds of arc — from any point to any other point within a full 360° — can be supplied.

If your operations involve circular spacing or angular positioning, the logical tool to reduce costs and insure greater accuracy is a rotary table. And to insure the model *and* the precision you need, it's logical to choose a Pratt & Whitney *Certified Accuracy* Rotary Table. For complete information, call the P&W Branch Office in your area... or write direct, outlining your requirements.

PRATT & WHITNEY COMPANY, INC.
16 Charter Oak Boulevard, West Hartford, Connecticut

100th Anniversary 1860 P&W 1960

PRATT & WHITNEY®
FIRST CHOICE FOR ACCURACY
MACHINE TOOLS • GAGES • CUTTING TOOLS



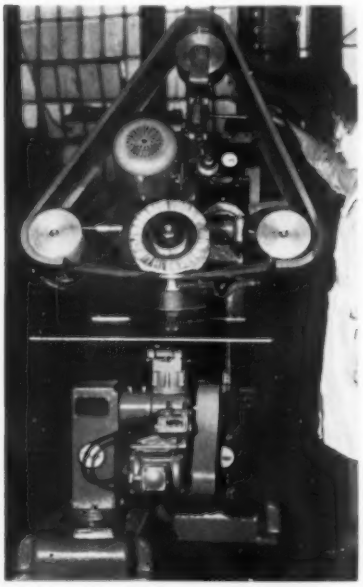
TILTING, HAND-AND POWER-ROTATED,
in 10″, 16″, 24″ and 36″ Diameters

VERTICAL, POWER-ROTATED,
in 30″ and 48″ Diameters

TOOLS of today

Polishing Unit

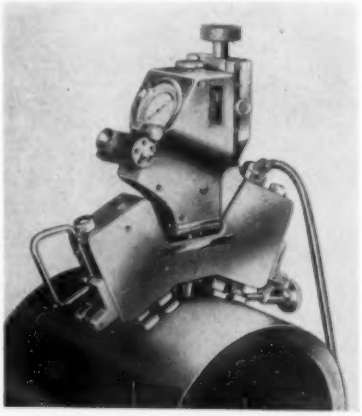
Slack-belt operations and jobs requiring the backing-up of the abrasive belt with a contact wheel or platen can be done with this abrasive belt head. The DLS unit will polish either contoured or flat work. An air cylinder maintains and adjusts belt tension on the tracking pulley. Belt tracking is fast and positive through hand knob adjustment. Wide spacing between the two idler pulleys gives the belt opportunity to retrack and permits the polishing of sharply contoured work. The belt head unit is available with a variety of controls, accessories and alternate arrangements.



Divine Brothers Co., 200 Seward Ave., Utica 1, N. Y. **Circle 452**

Portable Hardness Tester

Hardness ranges from 150 to 1100 DPH (Diamond Pyramid Hardness, or Vickers) are within the capacity of this unit that tests either flat or curved surfaces of parts in awkward or inaccessible places. The portable tester is held by an electromagnetic clamp having four pole pieces, two of which can be adjusted to accommodate different degrees of curvature. The instrument can test grooves with a minimum width of two inches and depths up to seven inches. Standard loads up to 30 kg are manually applied by a hydraulic unit. It has a 3½-inch objective and the indentor is a 136-deg pyramid-shaped diamond, fitted into a sliding turret and



remotely controlled from the body of the instrument. An optical indicating micrometer measures impressions with an accuracy of ±0.001 mm.

Steel City Testing Machines, Inc., 8817 Lyndon Ave., Detroit 38, Mich. **Circle 453**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hardness Tester

Positive load application is assured in this unit through a direct reading pressure gage that shows pressure to be applied before the test is made. The air pressure regulator is manually adjusted to show the desired Brinnell load. Any number of tests can be made in rapid sequence after the load is set. As the ball penetrates the specimen, its depth is determined and hardness number indicated on a separate gage on the side of the unit. Microscope readings are eliminated. The machine operates on an air supply of 1.2 cu ft of delivered air per minute at pressures above 65 psi. Load application accuracy maintained is ± one percent.

Tinius Olsen Testing Machine Co., 960 Easton Rd., Willow Grove, Pa. **Circle 454**

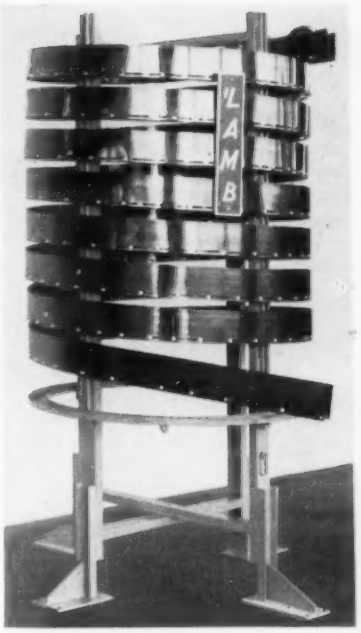
Rivet Spinner Heads

Air-operated, motor-driven spinner heads are self-contained units with a clean sweep underneath the mounting pad that allows them to be set up in conjunction with dial feeds or in other ways required for automatic assembly. Model E has capacity for rivets 1/8 inch in diameter and Model G for rivets 5/16 inch in diameter.

High-Speed Hammer Co., 313 Norton St., Rochester 21, N. Y. **Circle 455**

Storage, Lowering Unit

Chuting coiled around and attached to a frame provides a helical storage and lowering unit for application in automatic part handling installations that produce parts with rolling or sliding characteristics. Part flow through the unit is gravitational and constant. Critical surfaces are protected by rapid deceleration and centrifugal force braking action. Storage capacity is depen-



dent upon part size. The unit can be assembled to conform to space limitations more than 10 inches in diameter. Chuting configuration is made to suit part dimensions. Electrical part flow control and machine interlocks are optional, as is oil drip rail. The unit it available in floor type or suspended models.

F. Jos. Lamb Co., 5663 E. Nine Mile Rd., Detroit 34, Mich. **Circle 456**

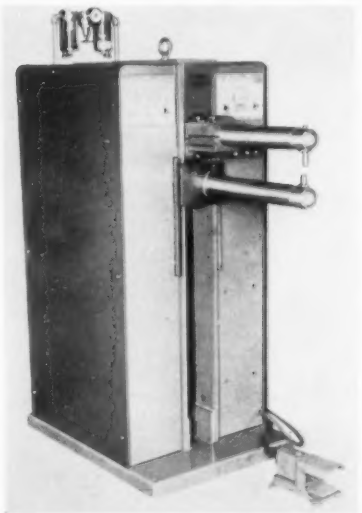
Diamond Drill Grinder

Marked in increments and mounted on a dovetail slide, the etched plate of this unit permits utilization of the entire grinding wheel. Drills can be positioned for grinding at any point on the face of the wheel, eliminating excessive wheel wear. A turret type quadrant swings the desired drill locator in direct line with the swinging arm of the grinder. Diamonds in wheel dressers are presented to the wheel at a 15-deg angle for self sharpening. Periphery of the wheel is dressed at a 5-deg angle, providing sharp edges for web thinning. A positive lock on the motor base secures the unit during dressing of the wheel. Mist coolant provides improved finish and longer wheel life.

Edward Blake Co. Inc., 570 Pleasant St., Watertown 72, Mass. **Circle 457**

Convertible Spot Welder

Quickly convertible to foot, air rocker or air press operation without drilling holes, welding or similar construction, the Series 300 spot welder has adjustable throat design that permits in or out movement of the welder arms and raising or lowering of the lower arm. Both arms can be raised or lowered on press type welders. Continuous heat control provides an infinite number of current adjustments from 100 down to 20 percent, making possible finer adjustment and extended welding capacity. The welder's Class H insulated transformer normally operates at less than 100 C, but will withstand temperatures in excess of 500 C, assuring long-life service under severe environmental conditions.

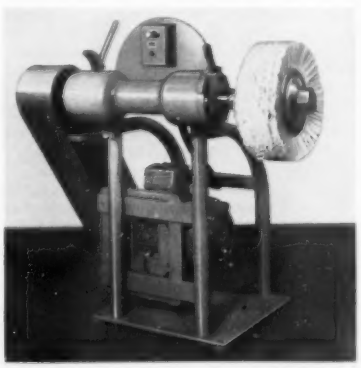


The unit can be connected to either a 220-volt or 440-volt service without component change.

Peer Inc., 1200 Milton St., Benton Harbor, Mich. **Circle 458**

Finishing Lathe

Polishing, buffing, deburring and brushing of metal parts can be done with this low-cost lathe. The carbon alloy steel spindle runs in permanently lubricated bearings within a sealed, cast-iron housing. Bearing life is preserved by a provision for spindle ex-

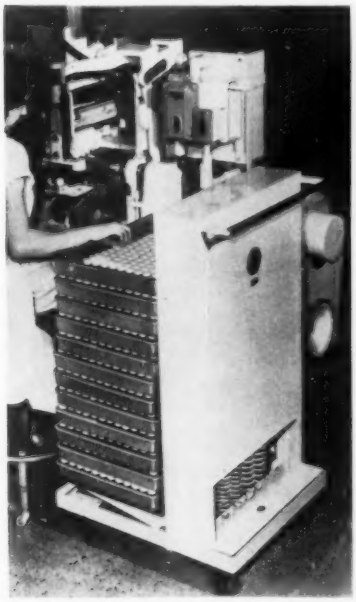


pansion under operating conditions. Lathe capacity is from 10 to 20 hp. The spindle is driven by multiple V-belt sheaves that can be replaced by removal of a sheet metal guard. Speeds can be varied by changing motor sheaves. Distance from spindle housing to inside wheel flange is 8 inches, and width between flanges is 6 inches. Arbors are available in diameters of 1½ to 2 inches.

Murray Way Corp., P.O. Box 180, Birmingham, Mich. **Circle 459**

Work Positioner

Cantilever type, self-leveling work positioners provide accessibility of parts from three sides, allowing steady, uninterrupted production. The model illustrated has an adjustable calibrated spring mechanism that automatically positions material on the top layer at convenient work level, regardless of the amount of material on the platform.



Capacity of the mobile unit is up to 800 lb. Empty tote boxes and trays can be stored under the platform as they are emptied.

Lowerator Div., American Machine & Foundry Co., 261 Madison Ave., New York 16, N. Y. **Circle 460**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Remote Control for Forging Hammers

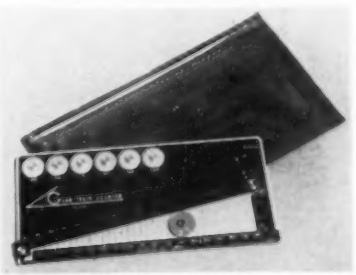
A remote control unit replaces the two heavy, frame-mounted valve levers on forging hammers of 2500 lb and larger. The control console, located within 20 ft of the hammer, is away

from heat and flying scale and provides the operator with a clear view of the forging operation. The hydraulically assisted levers of the unit allow easier and more rapid movements of the forging hammer ram, allowing more work to be done per heat. The manufacturer's Model L high-frame or double-frame forging hammers have the control system, and kits are available for installing the system with flat die hammers already in service.

Chambersburg Engineering Co., Derbyshire St., Chambersburg, Pa. **Circle 461**

Gear Teeth Counter

The simple operation and direct reading feature of this instrument quickly show the number of teeth and OD of any fine-pitch gear. The selected gear is first checked for pitch. If unknown, the gear is engaged with each of the test gears on the panel until proper meshing indicates the correct pitch.

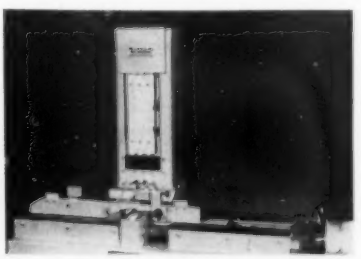


The adjustable sine bar is set for the indicated pitch and the gear is slipped into a wedge area and shifted towards the apex of the wedge until the gear binds. The vertical scale line immediately to the left and tangential to the gear is read directly, immediately indicating the number of teeth.

PIC Design Corp., 477 Atlantic Ave., E. Rockaway, L. I., N. Y. **Circle 462**

Slot Inspector

Slots as small as 0.050 and smaller holes in long parts such as computer bars can be measured to less than a

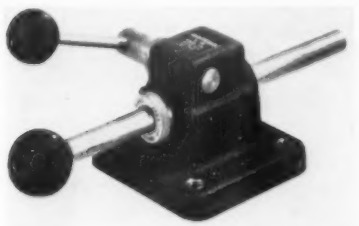


tenth accuracy with this inspection instrument. It inspects hole location and center distance, slot width and depth of various-shaped cavities in rectangular and round parts of various thicknesses and width up to 12 inches long. The unit consists of a gage table and three-column air gage instrument. A one-inch range micrometer is located at one end of the table.

The Sheffield Corp., Dayton 1, Ohio. **Circle 463**

Adjustable Jig Lock

Jig and fixture design are simplified and special locking details eliminated through use of this quickly adjustable jig lock. Turning of the control automatically adjusts the holding pressure

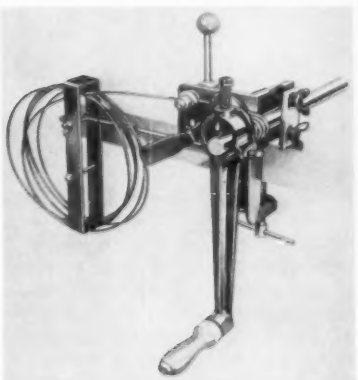


from 1 up to 1500 lb. Hand pressure locks and holds the rigid or nonrigid work in position without distortion. No clamping or holding tools are required. Two models provide base dimensions of 4 x 4 or 5 x 5 inches.

L-W Chuck Co., 45 S. St. Clair St., Toledo 4, Ohio. **Circle 464**

Spring Winder

Extension, compression and torsion springs are quickly and easily wound with this unit that produces springs in sizes of from ⅛ to 1¼-inch ID, with either right or left-hand coils, and of any length in wire sizes ranging from



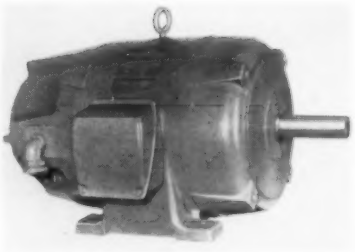
fine music wire up to 7/16-inch diam tempered spring wire. The winder can

be clamped to a workbench or held in a vise. Mandrels of ⅛, ¼, ⅜, ½, ⅝ and ¾ inch; four ¼-lb coils of 0.029, 0.047, 0.067 and 0.085-inch spring wire; and a wrench are included with the standard model.

Canadian Advance Car Mover Co., 144 Ross St., Welland, Ont., Canada. **Circle 465**

Induction Motors

Wound-rotor induction motors provide high starting torque with low starting current. These motors are designed primarily for adjustable or constant-speed drives that require special starting characteristics. They cover all

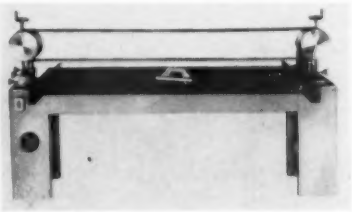


standard ratings in frame sizes 254 through 326, representing motors from 2 to 30 hp up to 1800 rpm. The motors are useful in severe reversing, plugging service and for frequent starting and stopping in such applications as cranes, hoists and bending rolls.

Westinghouse Electric Corp., P. O Box 2099, Pittsburgh 30, Pa. **Circle 466**

Finishing Machine

Unsually large sheets of wood, plastic and ferrous and nonferrous metal can be finished with this hand-stroke belt sander. The reciprocating worktable measures 84 x 28 inches. The machine



is available with either an individual dust collector system or a dust connector hood which connects to a plant-wide system. An auxiliary worktable for small parts finishing is optional.

Boice-Crane Co., 934 Central Ave., Toledo 6, Ohio. **Circle 467**

USE READER SERVICE CARD ON PAGE 203 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Metal Fabricator

Need for pressurized air is eliminated by an electro-hydramatic head which controls the ram's power stroke in this machine. The unit is designed for punching, notching and nibbling, particularly for prototype work, in short or medium production runs.

Model 15A punches round or shaped holes up to 3½-inch diam in sheet material up to ¼-inch mild steel. Maximum notching capacity is 5 x 5 inches in ⅛-inch mild steel. It will do straight line or contour shearing at 165 spm in ⅛-inch mild steel.

Wales-Strippit, Inc., 211 S. Buell Rd., Akron, N. Y. **Circle 468**

TOOL ENGINEERING in Europe

By H. Kronenberg
Consulting Engineer
Cincinnati 6, Ohio

Hot Spraying of Metals

Use of spray guns in the hot coating of metals is described in an article by F. Princ, Prag, Czechoslovakia, published in *Technische Zeitschrift fuer Praktische Metall Bearbeitung*, No. 1, 1960, p. 27-31, under the title "Heiss Spritzen von Metallen und Anderen Stoffen." Molten particles are shot into the surface of the workpiece, which has been sandblasted or cleaned by a similar method. The particles solidify after cooling, producing a surface layer of any desired thickness.

Microstructural investigations proved that the surface layer represents a new type of material, composed of sintered particles and inhomogeneous structures in which the crystals remain separated and are interlocked by deformation only.

The physical properties of the surface layer differ substantially from those of the material originally used in the spraying process. Resistance to abrasion, hardness and compressive strength are considerably increased. On the other hand, the produced surface may be brittle and of low tensile strength. Adhesion of the layer to the base material is of a mechanical nature as indicated by the fact that the particles penetrate into the geometrical irregularities of the original surface.

This method is being used for reclamation of worn shafts, protection against corrosion, repair of journal bearings and porous portions of castiron workpieces, sealing of microporosity of cast walls, producing metallic surfaces on nonmetallic parts, and similar applications.

Various types of guns for spraying molten metals, powders, wire, sintered carbides and glass are described. Information is given on the preparation of the base material (sandblasting or hammering or machining), and also on the spraying operation itself. The stream of molten metal must hit the base material at an angle larger than 45 deg. Turbulence or reflection of the spray occurs when the angle of engagement is less than 45 deg. Other sections of the article deal with finishing operations, chemical treatment of aluminum, and heat treatment.

Machinability Testing Methods

Various methods for testing machinability are discussed by H. Siebel in an article published in *Industrie Anzeiger*, Vol. 81 (36), p. 554-558, under the title "Methodik der Zerspanarkeits Pruefung."

The author says that tool life and tool wear are influenced by the machine tool, the cutting tool and the materials used in the tests and also by the method and instruments employed for measuring. All these factors must be taken into consideration in the evaluation of experiments.

As far as the cutting tools are concerned, it is necessary to watch the geometrical accuracy and finish in order to be able to duplicate test results. Silicon carbide wheels are recommended for tool grinding. Diamond grinding wheels are recommended for finishing. It is considered essential to avoid disturbing the grain structure of the tool material.

The Human Element

Four articles in the February issue of *Werkstatts Technik*, 1960, deal with the human element in manufacturing processes.

An article by G. Lehmann covers work physiology under the title "Arbeits Physiologie." One by E. A. Mueller is concerned with physical training in relation to industrial work ("Muskel Training und seine Bedentung fuer die industrielle Arbeit"). The third paper (by A. Kirn) deals with the selection of the work place according to the human constitution ("Auswahl des Arbeitsplatzes nach der menschlicken Konstitution"), while physiology is taken into account by F. Stier in his contribution, which deals with the development and use of small presses ("Arbeits Physiologische Gesichtspunkte beim Entwurf und Einsatz Kleiner Pressen").

The editor of *Werkstatts Technik* (Prof. C. M. Dolezalek) has written an introduction to this issue, indicating that the machine has taken over such a great portion of physical work in a shop and that it has been found advantageous to reverse this trend and to reassign a reasonable amount of physical work to the men in the shop.

E. A. Mueller recommends training the muscles systematically in order to avoid their deterioration, which often causes insufficient blood supply and even heart trouble. In a chart it is shown that barbers have the highest death rate due to heart trouble, while miners, dock workers and farmers have the lowest death rate, although their physical work is usually greater than that of barbers. Toolmakers are in the high death rate category while operators of forging hammers are in the medium range. Muscle training can often be accomplished without active sport, simply by short-time (10 seconds, several times a day) exercise.

G. Lehmann has found that a few very short rest periods are much more effective for restoration of working capacity than longer rest periods. He recommends rest periods of about three minutes, except in cases of very heavy physical work where more than four calories per minute are consumed. The author discusses details of the work load for men and women, recreation, effect of speed of work on fatigue, and indicates that physiology and psychology must be considered separately in the case of research on these problems but should not be separated in the case of practical application due to the fact that the white and blue-collar worker is always a composite of soul and body.

A. Kirn's article deals with the effects of heat, day and night shifts and conveyor type work. He has found that a certain type of worker prefers monotonous work, while others have the opposite reaction. Similar considerations apply to the effect of heat on the human body, and consequently to the selection of the type of work best suited for an individual.

F. Stier has studied the dimensions that a small press should have from the standpoint of ease of operation.

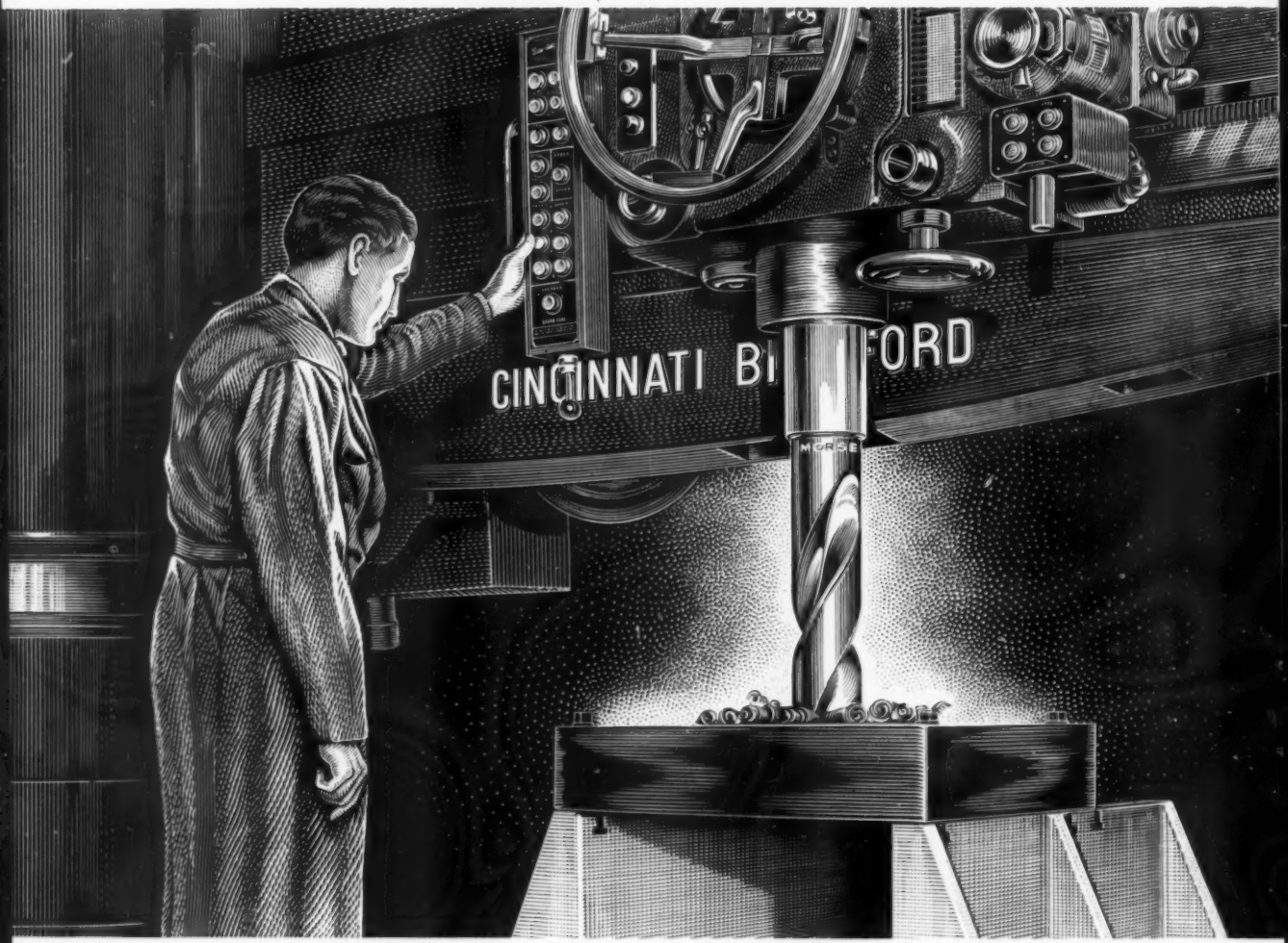
Face Milling

A report published in *Werkstatts Technik* Vol. 50, No. 1, 1960, deals with face milling operations. The article is by I. N. Kosenko and is titled "Die Optimale Geometrie der Messerköpfe und die Zerspanungs Bedingungen bei der Bearbeitung von Werkzengstahl."

The original investigations, carried out in the U.S.S.R., were conducted to determine the optimum metal-cutting data for the face milling of tool steel. The axis of the cutter was placed eccentrically with regard to the centerline of a workpiece clamped to the table of a vertical milling machine. The machine was of high rigidity and was equipped with a large range of feeds and speeds.

A flywheel of about 16¾-inch diameter and about 4 inches high was attached to the milling cutter to obtain a uniform rotation of the tool. The results of the tests confirmed the conventional finding that cutting speed has a greater effect on tool life than feed.

MORSE...CINCINNATI BICKFORD GIVE A SHOW OF STRENGTH



Morse tough tools easily take the thrust of world's most powerful radial drill... utilizes its full power.

Cincinnati Bickford caused many a drill manufacturer to throw up his hands when they looked for a drill tough enough to stand up under the thrust of the most powerful radial drill ever built. They found what they wanted at Morse... a regular taper shank drill right off the shelf.

Let Morse provide the easy solution for your tough jobs. Your Morse-Franchised Distributor will give you full details. Call him today.

MORSE

means "THE MOST" *in Cutting Tools*

MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASSACHUSETTS

Warehouses in: NEW YORK • CHICAGO • DETROIT • DALLAS • SAN FRANCISCO

Use Reader Service Card, CIRCLE 95

Morse means more production... smoother, more accurate production . . . with every type of cutting tool from drills, reamers, taps and dies, to end mills, milling cutters, slitting saws and "specials". So, if you want the best from every cutting tool you buy, mark your order "MORSE". For if you want *Morse Quality*, there's only one way to get it . . . *specify Morse.*

VAN

A Division of VAN NORMAN INDUSTRIES, INC.

2375

Trade Literature

for free booklets and catalogs—use request card, page 203

A DETAILED APPROACH to the systematic appraisal of product value in business purchasing is covered in publication GED-3877, "Productive Purchasing." General Electric Co. **(Circle 301)** . . . "Photomicrography of Metals" is a 46-page reference guide that reviews the latest techniques in metallurgy. Eastman Kodak Co. **(Circle 302)** . . . An eight-page case study containing before and after results is titled "Noise Reduction and Bar Stock Protection with Byers PVC Stock Tubes." A. M. Byers Co., **(Circle 303)** . . . Engineering Handbook CH illustrates and describes liquid compressible devices. Taylor Devices, Inc. **(Circle 304)** . . . "Producers for the Plant" details selection and supervision of plant equipment. Ingersoll-Rand Co. **(Circle 305)** . . . A 12-page brochure provides nomographs and allignment charts to facilitate estimates of costs incurred by industrial trucks. Lead Industries Assn. **(Circle 306)** . . . Details of the Hertz Engineering Scholarship Foundation are presented in a 12-page brochure. **(Circle 307)** . . . Ways for solving dust, dirt and mist collecting problems are described in a 16-page catalog. Hammond Machinery Builders, Inc. **(Circle 308)**

Bearings

High-precision thin-width instrument bearings are described in Bulletin 6002. Miniature Precision Bearings, Inc. **(Circle 309)** . . . Type HDR high-precision radial ball bearings are described in Catalog 60. Split Ballbearing, Div. of M P B, Inc. **(Circle 310)**

Boring, Drilling Tapping & Threading

Bulletin F-99-33 covers design and operating features of a line of thread rolling heads. Landis Machine Co. **(Circle 311)** . . . Bulletin 506 describes a universal drilling, tapping, boring and reaming machine. Wisconsin Drill Head Co. **(Circle 312)** . . . Deep hole drills are described in a four-page, illustrated folder. Pratt & Whitney. **(Circle 313)** . . . Universal joint, adjustable spindle, multiple drilling and tapping heads are covered in six-page, illustrated Bulletin 600C. Ettco Tool & Machine Co., Inc. **(Circle 314)**

Clamps

"Tiny Toggle" and miniaturized clamps are described in Bulletin 102105. Detroit Stamping Co. **(Circle 315)** . . . Bulletin 601606 details three models of plunger type toggle clamps. Detroit Stamping Co. **(Circle 316)**

Cleaning

Three models of machines for high-pressure washing of paint masks are described in a two-page data sheet. Conforming Matrix Corp. **(Circle 317)**

Cutting Tools & Holders

The company's line of standard carbide cutting tools and special engineering services are presented in Catalog 114. Dixie Tool Industries. **(Circle 318)** . . . A color catalog describes a line of rotary carbide and high-speed cutting tools, burrs and countersink sets. Rico Tool Co. **(Circle 319)** . . . Performance Report No. 596 describes increased production and lowered costs through the use of carbide cutters. Kennametal, Inc. **(Circle 320)**

Drafting Materials

A quick reference chart for printed circuit draftsmen provides a six-page table that includes all of the necessary precut shapes and sizes of pressure sensitive drafting aids. By-Buk Co. **(Circle 321)**

Electric Motors, Controls & Drives

The Parmatic Speed Variator, a compact, packaged, adjustable speed, d-c motor drive that operates from a-c power, is described in eight-page illustrated Bulletin GEA-7012. General Electric Co. **(Circle 322)** . . . A six-page, illustrated bulletin, No. F-1974, describes the operation and special services of the company. U. S. Electrical Motors, Inc. **(Circle 323)**

Fasteners

Dimensions and data on the 1960 cap screw series are presented in an illustrated bulletin. Set Screw & Mfg. Co. **(Circle 324)**

Finishing & Grinding

Two-page Bulletin AW-1 covers a complete line of depressed center wheels, including a new fast-cutting type. Raybestos-Manhattan, Inc. **(Circle 325)** . . . "H-VW-M Plating and Polishing News" is a quarterly publication available to all members of the metalfinishing trade. Hanson-Van Winkle-Munning Co. **(Circle 326)** . . . A two-page data sheet covers various abrasive finishing methods and recommends compounds, type of buff and buff speeds. The Lea Mfg. Co. **(Circle 327)** . . . Titled "A New Look at Grinding Costs," the lead article in the second issue of Diamond Data provides a plan for establishment of a grinding wheel evaluation program at the production level. Industrial Diamond Div., Engelhard Hanovia, Inc. **(Circle 328)** . . . Bulletin 560-1 describes a compact line of precision surface grinders. Covel Mfg. Co. **(Circle 329)** . . . A machine for grinding annular forms and grooves in workpieces up to 10 inches in diam and 24 inches between centers is described in Catalog FG-181-260. The Sheffield Corp. **(Circle 330)** . . . Catalog G-60 covers the company's line of air-powered grinders, sanders and wire brushing tools. Master Power Corp. **(Circle 331)** . . . Illustrated Bulletin ESA-310 describes a line of grinding wheels that use both man-made and natural diamonds. Simonds Abrasive Co. **(Circle 332)**

Fluid Power

Twelve-page Bulletin 91023 describes a line of three-way valves for air, oil, water, gas, chemical or vacuum service. Airmatic Valve, Inc. **(Circle 333)** . . . "Twin Air" rotary screw type air compressors are detailed in four-page folder A-1141. Atlas Copco. **(Circle 334)**

Gears & Gearmaking

A line of stock and special gears designed to meet all industrial power drive requirements is detailed in a four-page brochure. Ohio Gear Co. **(Circle 335)** . . . Bulletin 50 describes an expanding plug gage equipped for between-pin gaging of internal splines and gears. Comtor Co. **(Circle 336)** . . . "Essentials of Rotary Gear Shaving" is an illustrated, 18-page reference manual covering basic gear production and gear shaving information. National

Trade Literature

Broach & Machine Co. **(Circle 337)** . . . An eight-page pamphlet introduces a new low-cost gearing system that provides a high degree of insensitivity to mounting errors. Spiroid Div., Illinois Tool Works. **(Circle 338)** . . . "An Advanced Concept of Modern Gears" presents 12 pages that describe the advantages of using hardened and ground gears in varied applications. Write S. A. Roth, Philadelphia Gear Corp., Schuylkill Expressway, King of Prussia, Pa.

Heat-Treating

Bulletin B-81 covers the use of furnaces and equipment for heat-treating stainless steel as strip, sheet, tube, wire, bar and formed and machined products. Drever Co. **(Circle 339)** . . . A line of combustion tube furnaces capable of operating at temperatures of 2200 F are detailed in Bulletin 659. Hevi-Duty Electric Co., Div. of Basic Products Corp. **(Circle 340)** . . . Full muffle, hydrogen atmosphere, hand pusher furnaces are described and illustrated in Bulletin 260. Lindberg Engineering Co. **(Circle 341)** . . . A six-page bulletin covers a line of industrial furnace equipment for heat processing and offers an equipment selection guide for particular process requirements. Sunbeam Equipment Corp. **(Circle 342)**

Indexing

Four basic series of general purpose clutches for indexing, backstopping and over-running applications are described in condensed Catalog FS-859. Formsprag Co. **(Circle 343)**

Inspection & Measurement

Catalog 35 covers mechanical dimension gages, including eleven new products, in 56 illustrated pages. Standard Gage Co. **(Circle 344)** . . . What optical comparators are and what they do is simply and colorfully detailed in a 22-page booklet. Jones & Lamson Machine Co. **(Circle 345)** . . . A strip film and disk recording, available for loan to groups within industry, government, education and technical societies, explains the principles and applications of the microptic auto-collimator. Engis Equipment Co. **(Circle 346)** . . . Portable torque tension testing equipment and various instrument applications are described in illustrated Bulletin 214. Skidmore-Wilhelm Mfg. Co. **(Circle 347)** . . . Equipment for speed measurement is covered in Catalog 2659. Sevo-Tek Products, Inc. **(Circle 348)** . . . Four-page specification S153-23 describes the operating features of a new universal multipoint recorder. Minneapolis Honeywell Regulator Co. **(Circle 349)** . . . Specification sheets S801-4, S801-5 and S801-6 detail three new units for position-proportioning, time-proportioning and current-proportioning of motors or actuators, solenoid valves and electric furnaces using magnetic amplifiers. Minneapolis-Honeywell Regulator Co. **(Circle 350)**

Lathes

A new, medium duty engine and tracer lathe is fully described in Bulletin 1001. The American Tool Works Co. **(Circle 351)** . . . "Manufacturing Program 1960" presents technical information and illustrations of a line of precision machine tools. Misal S. A. S. Leto Machine Tools. **(Circle 352)**

Lubrication & Cooling

Die Headlines, Vol. V, No. 3, provides an H & G cutting oil chart to aid in selection of the proper grade of cutting lubricant for various metals. The Eastern Machine Screw Corp. **(Circle 353)** . . . "Performance of SCL Industrial Lubricants" is a detailed, illustrated report presented in a 10-page brochure. The Elco Lubricant Corp. **(Circle 354)**

Materials

Bulletin 157 contains a detailed chart showing comparative specifications, chemical analyses and minimum physical properties of the company's nonferrous alloys, as well as component parts and assemblies regularly produced by the centrifugal method. Centrifugally Cast Products Div., The Shenango Furnace Co. **(Circle 355)** . . . "Cr-Mo-V Steel for Service at Elevated Temperatures" is a four-page technical re-

port by C. M. Cosman, Metallurgical Engineer, Vanadium Corporation of America. **(Circle 356)** . . . Sixteen-page Brochure 1-115 presents a summary of the forms, properties and applications of the manufacturer's silicone products. Dow Corning Corp. **(Circle 357)** . . . A 12-page technical brochure describes primary and mill products and their applications, as well as metallurgical tables and design information. Harvey Aluminum. **(Circle 358)** . . . Bearings, bushings, bar stock and babbitt metal are covered in a 16-page illustrated brochure. The American Crucible Products Co. **(Circle 359)** . . . A new chart indicates hot stamping foil properties and applications for work on plastics and other materials. The Arcomark Co. **(Circle 360)** . . . A new air or oil hardening hot work tool steel is described in a four-page, illustrated folder. The Uddeholm Company of America. **(Circle 361)** . . . "A Selection Guide to Heat Resistant Cast High Alloys," written by E. A. Schoefer, vice president, Alloy Casting Institute, is available as a 12-page reprint. Alloy Casting Institute. **(Circle 362)** . . . Bulletin G-10 points up operational advantages of the company's high-speed sheeting lines. Automation Div., F. J. Littell Co. **(Circle 363)** . . . "Harper Extruded Shapes—A New Concept," is a 16-page booklet containing information, photographs and schematic drawings describing unusual aspects of extruding steel and stainless steel. The H. M. Harper Co. **(Circle 364)** . . . Carbide grades, properties and applications are detailed in a four-page technical data paper, No. 50-1WM. Wesson Co. **(Circle 365)** . . . A new low-cost alloy of zinc, copper and titanium is described in a four-page booklet. Whitehead Metals, Inc. **(Circle 366)** . . . Bulletin 120 is the first in a series of high temperature application bulletins offering information on the use of ceramic tooling materials at elevated temperatures. Duramic Products, Inc. **(Circle 367)** . . . A new brochure contains the chronology of stainless steels from 1797 to 1933. Vanadium Corporation of America **(Circle 368)** . . . A four-page bulletin presents a comprehensive analysis of large polyolefin moldings. American Agile Corp. **(Circle 369)** . . . Nickel alloys for use in fabrication of high temperature and corrosion resisting springs are covered in technical bulletin T-35. Huntington Alloy Products Div., The International Nickel Co., Inc. **(Circle 370)**

Materials Handling

Solving of typical material positioning and handling problems through use of self-leveling work positioners is described and illustrated in a six-page brochure. Lowerator Div., American

Trade Literature

Machine & Foundry Co. **(Circle 371)** . . . Bulletin 3021 presents complete data and specifications on a line of lifting magnets designed for scrap handling. Stearns Magnetic Products. **(Circle 372)**

Milling

Catalog M-2110 is a 24-page presentation of the company's line of milling machines. The Cincinnati Milling Machine Co. **(Circle 373)** . . . An eight-page pictorial brochure covers a line of milling cutters, single and multipoint tools and accessories. O. K. Tool Co. **(Circle 374)** . . . Illustrated with photographs, diagrams and floor plan drawings, an eight-page bulletin offers technical information on the No. 3-36 hydraulic milling machine. Kent-Owens Machine Co. **(Circle 375)**

Plating & Painting

A 36-page, two-color booklet describes simple analytical methods for plating solutions, necessary equipment, component chemicals of solutions and other data. Hanson-Van Winkle-Munning Co. **(Circle 376)** . . . Sixty-four shades available in lacquers, synthetics, vinyls and specialty finishes in a complete scale of lustres at six levels are provided in a color card folder of industrial finishes. United Lacquer Mfg. Corp. **(Circle 377)**

Pressworking

A die saver switch control system that effects cost savings in die press operations is presented in a four-page folder. Robotron Corp. **(Circle 378)** . . . Straight sided, double crank, mechanical power presses are detailed in eight-page catalog SD2-60. Cleveland Punch & Shear Works Co. **(Circle 379)** . . . Fourteen different types of presses and machines are presented in an illustrated, eight-page brochure. St. Lawrence Hydraulic Co. **(Circle 380)**

Punches & Dies

"Lower Die Costs Through Standardization" presents six pages of information on the company's standard units for zinc and aluminum die casting. Detroit Mold Engineering Co. **(Circle 381)** . . . Four-page folder 457 gives specifications, application data and prices for a new punch line. Dayton Perforators, Inc. **(Circle 382)**

Sawing

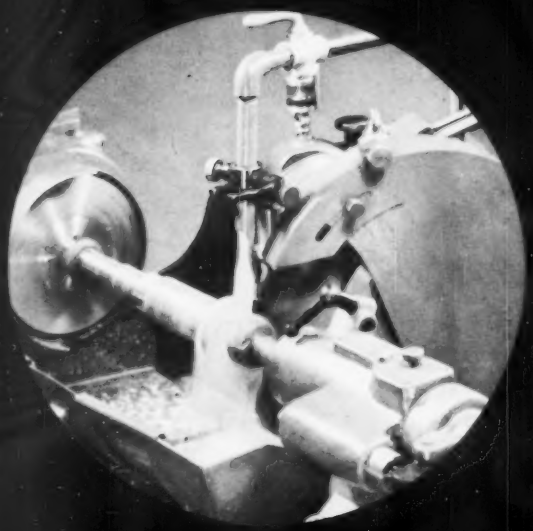
The value of cut machining with circular abrasive saws is described and illustrated in a 28-page catalog. Wallace Supplies Mfg. Co. **(Circle 383)**

This is

Stuart's

new
HI-D
at work

This is what **HI-D** is . . .



A new *transparent* metalworking compound . . . a *petrochemical* compound possessing the high detergency of synthetics but none of their disadvantages. Often described as a hybrid—Hi-D is not truly an emulsion, and not anything like a straight chemical compound. Turn the page to see how this new type of cutting fluid can help you . . .

This is what

Stuart's

new **HI-D** will do...

Keep grinding wheels open and free-cutting. Permit standardization of wheels—do more different jobs with fewer wheels. Minimize machine tool maintenance. Aid chip formation to produce fine surface finishes. Lubricate efficiently as it cleans. Remain effective and stable at 60:1 for grinding and at 40:1 for cutting—even after picking up tramp oil. Settle chips quickly in an ordinary sump—produce controlled foam in a flotation-type filtering system. Inhibit rust, even at mixtures greater than 60:1.

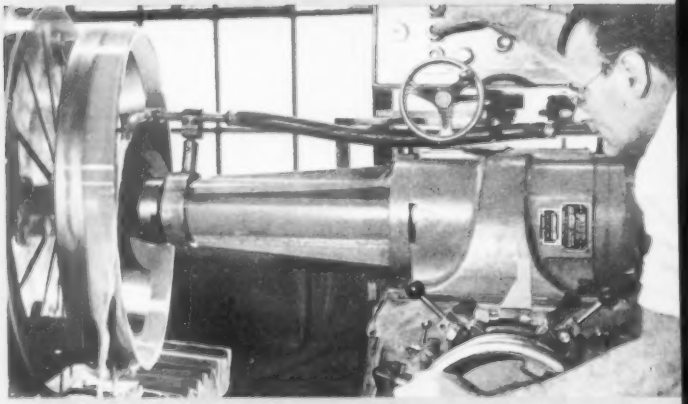
This is how

Stuart's

new **HI-D** has helped others...

LaSalle Steel Company reduced cutting fluid costs by 45%, using Hi-D for everything from ¼" roughing cuts on lathes to fine finish grinding. At 50:1, Hi-D stops in-plant rust on highly finished steel bar stock.

The Torrington Company, Bantam Bearing Division, saves ⅓ on lubricant costs by using Hi-D at 60:1 on 87 grinders. Hi-D trims *hidden costs,* too, because Torrington dresses wheels only ⅓ as often as before. Think of the savings in wheel and diamond life. Direct costs are slashed on some jobs because both rough- and finish-grinding are done with the same wheel. As for finish, Hi-D eliminates 95% of chip "feedback" from the filtering system.



Stuart's HI-D replaces five cutting fluids in diversified plant

Here's how Hi-D's combination of detergency and lubricity slashes lubrication costs for one company on 20 different jobs that range from sawing to surface grinding:

1. **Sawing**—Elimination of chip welding improves blade life. Ability to perform at 10:1 (5:1 formerly required) reduces carry-off and waste.
2. **Turning**—Production is increased by stepping up feed from .030 to .060 ipm. Depth of cut is increased from ⅜" to ¾".
3. **Mills**—Rancidity is eliminated.
4. **Surface grinding**—Wheel life is increased, downtime is decreased, because petrochemical compound Hi-D keeps wheels open and free-cutting.

On every application, Hi-D matches or betters the performance of five compounds replaced. Cutting fluid inventory and handling costs are reduced. Using Hi-D in the toolroom and cutoff department (serviced by a central system) saves 50 to 60 gallons of cutting fluid per week.

The way to evaluate potential savings in *your* plant is to test Stuart's new Hi-D on a variety of operations. Or, send for free test samples of Hi-D in both concentrate and mixture form that will demonstrate its transparency, lubricity, and stability. Phone your Stuart representative or the factory—BIshop 7-7100.

FREE SAMPLE

Stuart

D. A. STUART OIL CO., LIMITED
2727 South Troy Street, Chicago 23, Illinois

CANADIAN D. A. STUART OIL CO., LTD.
P.O. Box 430, 43 Upton Road, Scarborough, Ontario, Canada

Printed in U.S.A.

who's meeting and where

June 2-3. NEW YORK UNIVERSITY, COLLEGE OF ENGINEERING. Fourth annual summer conference on vacuum metallurgy. N.Y.U., University Heights 53, N. Y.

June 5-8. SPECIAL LIBRARIES ASSN., METAL DIV. Information sessions during 51st Annual Convention. Cleveland, Ohio.

June 5-9. ASME. 1960 Semi-Annual Meeting and Aviation Conference. The Statler-Hilton Hotel, Dallas, Tex.

June 5-10. PENNSYLVANIA STATE UNIVERSITY. Machinability Seminar. The Conference Center, University Park, Pa.

June 6-7. MALLEABLE FOUNDERS SOCIETY. Annual Meeting. Elbow Beach Surf Club, Hamilton, Bermuda.

June 6-8. MATERIAL HANDLING INSTITUTE, INC. New England Show. Commonwealth Armory, Boston, Mass.

June 8-11. NSPE. Annual Meeting. Statler-Hilton Hotel, Boston, Mass.

June 9-10. THE UNIVERSITY OF WISCONSIN, EXTENSION DIV. Foundry Practices Institute. Wisconsin Center, Langdon and Lake Sts., Madison, Wis.

June 9-12. SOCIETY OF WOMEN ENGINEERS. Tenth Annual Convention. Benjamin Franklin Hotel, Seattle, Wash.

June 10-26. FEDERATION OF BRITISH INDUSTRIES. British Exibition. Coliseum, New York, N. Y.

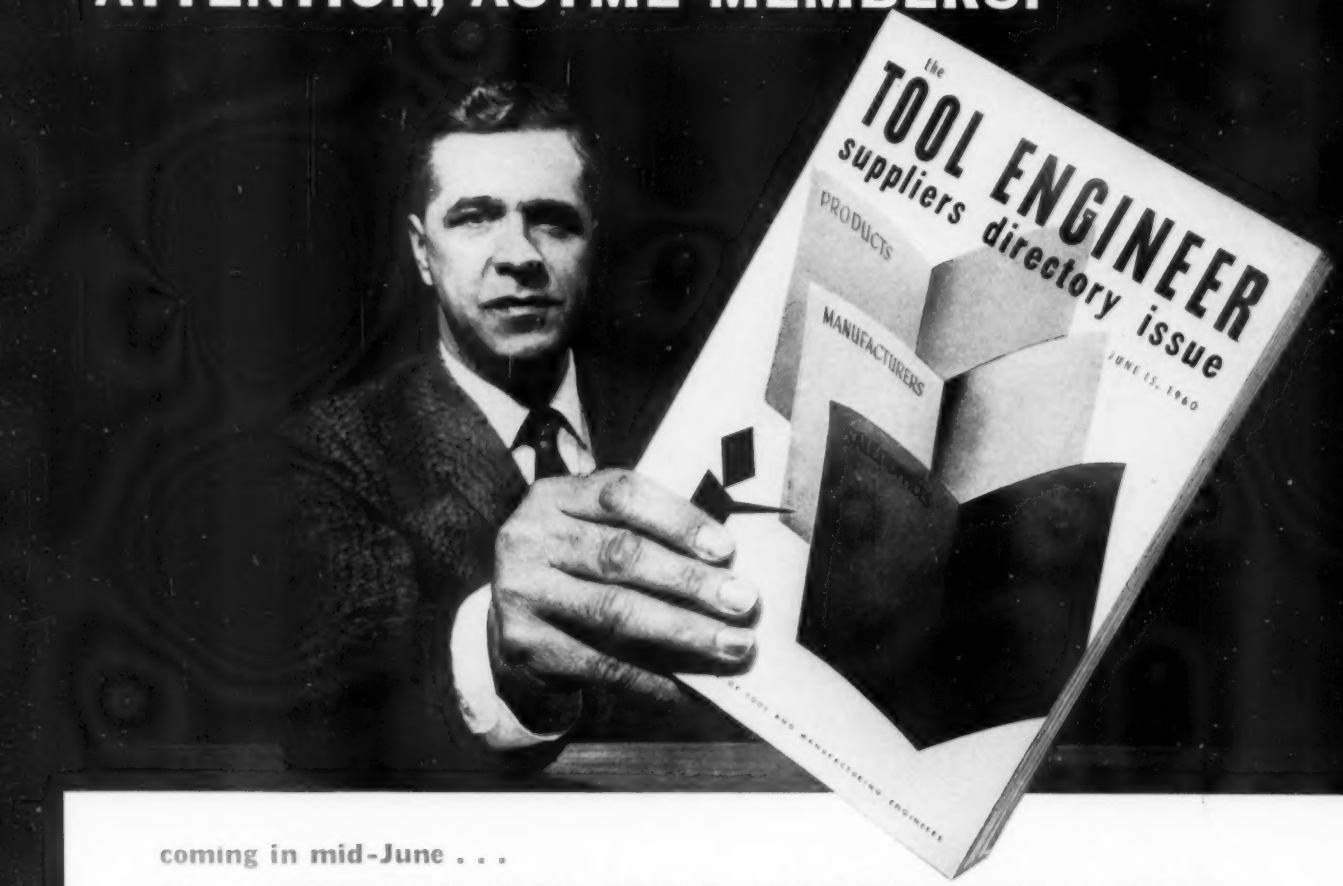
June 12-17. PENNSYLVANIA STATE UNIVERSITY. Design Engineering Seminar. The Conference Center, University Park, Pa.

June 12-25. INDUSTRIAL MANAGEMENT CENTER. Seventh Annual Material Handling and Packaging Training Course. Lake Placid Club, N. Y.

June 13-15. MPIF; POWDER METALLURGY COMMITTEE, METALLURGICAL SOCIETY; AND AMERICAN INSTITUTE OF

(Continued on page 189)

ATTENTION, ASTME MEMBERS!



coming in mid-June . . .

The 1960 SUPPLIERS DIRECTORY ISSUE of THE TOOL ENGINEER

Your "National Directory of Local Sources!"

Your time is mighty valuable. When you *need* a product vital to your work, you usually need it—*now!* You don't want to burn up precious hours seeking out the product source.

An exceptional time-saver in this respect is THE TOOL ENGINEER *Suppliers Directory Issue*—the expanded, improved 1960 version of which will be in your hands the week of June 15. This issue will give you *everything* you need in way of product information—including an *exclusive* means of finding local sources of products in *minutes* rather than in *hours* or *days*.

The Suppliers Directory Issue is "easy as A-B-C" to use. It contains three major, color-coded groups of listings, arranged alphabetically, cross-referenced and indexed for your convenience, as follows:

1 PRODUCTS SECTION (on blue pages)—listing 1,400 products important to tool and manufacturing engineers. Found under each heading are the names of manufacturers of that product.

2 MANUFACTURERS SECTION (on yellow pages)—presenting the names and home office addresses of 2,300 manufacturers. State and numerical designations which appear after the manufacturers' names identify their *local* sales outlets across the country.

3 SALES OFFICES SECTION (on pink pages)—giving you the names, addresses *and telephone numbers* of more than 20,000 local sources of needed products. This *exclusive* feature makes the Suppliers Directory Issue of greatest value to the user, the most useful reference of its kind in the industry.

In addition to this vital information, the Suppliers Directory Issue will contain helpful technical articles prepared by the editors of THE TOOL ENGINEER.

The Suppliers Directory Issue is published as the thirteenth issue of THE TOOL ENGINEER. It is included as a regular issue in the basic subscription price to ASTME members and non-members. Watch for it! Make good use of it!

The Tool Engineer

SUPPLIERS DIRECTORY ISSUE

Publication date: June 15, 1960

THE AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS

MINING, METALLURGICAL AND PETROLEUM ENGINEERS. International Conference on Powder Metallurgy. Biltmore Hotel, New York, N. Y.

June 13-24. UNIVERSITY OF MICHIGAN, COLLEGE OF ENGINEERING. Twelve technical courses ranging from Automatic Control to Theory of Computing Machine Design. For information address Raymond E. Carroll, Conference Coordinator, 126 W. Engineering Bldg., U. of M., Ann Arbor, Mich.

June 14-17. CORNELL UNIVERSITY, COLLEGE OF ENGINEERING. Industrial Engineering Seminars ranging from Industrial Management to the Theory and Applications of Statistical Reliability Analysis. For information address J. W. Gavett, Seminars Coordinator, Dept. of Industrial and Engineering Administration, Upson Hall, Cornell University, Ithica, N. Y.

June 19-21. ALLOY CASTING INSTITUTE. 1960 Annual Meeting. The Homestead, Hot Springs, Va.

June 19-22. INSTITUTO MEXICANO DE INGENIEROS QUIMICOS AND AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. International Congress of Chemical Engineering. Hotel Del Prado, Mexico City, Mexico.

June 20-24. ASEE. 68th Annual Convention. Purdue University, Lafayette, Ind. For information address Prof. Mark Roberts, Engineering Administration, Purdue University, Lafayette, Ind.

June 20-24. UNIVERSITY OF MICHIGAN, COLLEGE OF ENGINEERING. Technical course. Recent Industrial Engineering Developments. For information address Raymond E. Carroll, Conference Coordinator, 126 W. Engineering Bldg., U. of M., Ann Arbor, Mich.

June 20-July 5. CHICAGO ASSOCIATION OF COMMERCE AND INDUSTRY. 1960 Chicago International Trade Fair. Navy Pier Exhibition Hall, Chicago, Ill.

June 26-July 1. ASTM. 63rd Annual Meeting. Chalfonte-Haddon Hall, Atlantic City, N. J.

June 27-July 8. MASSACHUSETTS INSTITUTE OF TECHNOLOGY. Special summer program on Modern Developments in Heat Treating. M.I.T., Cambridge 39, Mass. For information address Dr. Warren M. Rohsenow, Professor of Mechanical Engineering, M.I.T.

CHECK FASTER

and with greater reliability of measurement

Made in West Germany

CARL ZEISS

Large Toolmaker's Microscope

This large toolmaker's microscope, made by Carl Zeiss, is a decided improvement over former instruments. It offers greater ease, greater rapidity and great reliability of measurement.

Has a measuring range of 3x6", permitting extensive application. Its new built-in gauge block displacement device makes it possible to quickly move the stage in the longitudinal direction in five steps and in the transverse direction in two steps, thus eliminating the old fashioned method of interchanging gauge blocks. All manipulations, adjustments and readings are performed from the same position in front of the instrument.

The inclined binocular tube can be tilted and adjusted to suit the convenience of the operator. During tilting, the image in the eyepiece always remains in focus. The object to be tested is seen simultaneously with the cross-line of the protractor. The scale of the protractor and templet, however, can be projected consecutively into the eyepiece.

BUILT-IN BEAM-SPLITTING DEVICE

Another novel feature of this instrument is the new built-in beam-splitting device with single or double reversed image in complementary colors for line-symmetrical or center-symmetrical measurements.

A small toolmaker's microscope is also available

Write for literature

COMPLETE SERVICE FACILITIES

CARL ZEISS, INC.

485 FIFTH AVENUE, NEW YORK 17, N. Y.

Iden F. Richardson, left, has been appointed a vice president of Hughes Aircraft Co. He will continue to serve as manager of the company's commercial products activities, a position to which he was named in 1959, shortly after he joined Hughes. Richardson spent 23 years with Bendix Aviation Corp. is a graduate of Purdue and holds a degree from Harvard University.

Announcement has been made of the appointment of John W. Elbin, right, as vice president of manufacturing, AmForge Div., American Brake Shoe Co. He will be responsible for manufacturing and product engineering at the Upset and Great Lakes plants of the division. Starting as a die sinker in 1936, Elbin has advanced to executive positions in several forging companies.

Men at Work

DONALD NEWELL has been promoted to tool and methods engineer for Wales Strippit, Inc. He formerly was with Niagara Machine and Tool Co. and Curtiss-Wright.

Election of J. D. GREENSWARD as president, Canadian Allis-Chalmers Ltd., a wholly owned Allis-Chalmers subsidiary, has been announced. He succeeds HAROLD M. SCHUDT who has been named director of manufacturing, Allis-Chalmers International. Greensward, who has been director of manufacturing, Industries Group, and a vice president of Allis-Chalmers since 1952, has held a wide variety of positions since joining the company in 1922.

WILLARD W. BROWN has been elected vice president—bearing group of Clevite Corp. He will have charge of the corporation's bearing manufacturing divisions, including Cleveland Graphite Bronze, Clevite Harris Products, and Clevite Ltd., Canada, as well as the Mechanical Research section of Clevite Research Center. Brown was formerly head of Cleveland Graphite Bronze Div.

The New Britian Machine Co. has announced the election of ROBERT T. FRISBIE, JR. as executive vice president. He is a director of the company and, until appointed to his new post, was vice president in charge of sales.

ROBERT T. CURCURU has been appointed a vice president of Pioneer Engineering & Mfg. Co., Inc., Detroit, and general manager of the new Wettlaufer Mechanical Engineering Div.

Announcement of the election of CHARLES F. ADAMS to the newly created position of chairman of the board of Raytheon Co., and of RICHARD E. KRAFVE as president of the electronics firm, has recently been made. Adams has been president of the company since 1948. Krafve, former vice president of the Ford Motor Co. who joined Raytheon in 1959 as group vice president-commercial, was elected executive vice president and a director last September.

Bertram Mintz has been appointed chief application engineer for the Aircraft Div., Hughes Tool Co. He came to Hughes from Marquant Aircraft Co. where he was a representative for research and development. Prior to that, Mintz served on the technical staff at Wright Air Development Center. He is a graduate of Georgia Institute of Technology.

Announcement has been made of the appointment of John P. Vederko to the position of vice president and general manager of the Douglas Tool Co., an affiliate of the Pioneer Engineering & Mfg. Co. Vederko, who joined Douglas in 1959, was formerly general manager of the London plant of the Ex-Cell-O Corporation of Canada, Ltd.

W. R. Timken has been elected president of the Timken Roller Bearing Co., Canton, Ohio. He succeeds D. A. Bessmer. A graduate of Harvard University, Timken started with the company in 1935, was elected a director in 1936 and became a vice president in 1941. G. L. Deal, P. J. Reeves and H. L. Tobey have been elected to the board of directors.

Harold R. Beachler, formerly work manager of the Etna plant, National Supply Co., has been appointed to the newly created position of manager of tubular production. He will be responsible for all manufacturing, engineering, research and product development at the company's Ambridge and Etna, Pa., mills and the Melrose Park, Ill., plant.

Men at Work

Edward E. Kirkham, left, chief development engineer at Pratt & Whitney Co. since 1958, has been named chief engineer of the machinery engineering department. Coming to the company in 1953 as a project engineer, Kirkham has been instrumental in the development of Pratt & Whitney's numerically controlled machine tools and inspection machines.

DONALD HENRY has been named assistant general manager of Rockwell Mfg. Co.'s Bellefontaine, Ohio, power tool plant.

CHESTER C. HOLLOWAY has been named president of Gilman Engineering and Mfg. Co., a wholly owned subsidiary of the Parker Pen Co. He replaces WILLIAM C. CUMMINGS who has joined the parent company as vice president and manager of the Eversharp Pen Co., a division of Parker.

William L. Lukens, right, has been elected to the position of vice president and assistant to the president of the National Twist Drill and Tool Co., Rochester, Mich. Formerly assistant to the president, Lukens has been with the firm for 24 years. His initial work was in the company's sales office at Philadelphia, Pa.

Henry R. Odell, right, was recently elected executive vice president of the Beloit Tool Corp. One of the founders of the company, Odell will continue to serve as treasurer. He was formerly associated with Besly-Wells Corp. and the Arthur Anderson Co. Odell attended the University of Chicago and Harvard University.

New general managers for the Marion Forge and Foundry divisions have been announced by Eaton Mfg. Co. PAUL W. OLSON, general manager of the Foundry Div., Vassar, Mich., for the past five years, has been appointed to a similar position at the Marion Forge Div., Marion, Ohio, succeeding T. A. MORETTI who has been transferred to special assignments at the corporate level. GEORGE R. FRYE, formerly factory manager of the Foundry Div., has been promoted to general manager succeeding Olson.

James L. Woodley, right, for the past five years manager of the Hyster Co. Danville, Ill. plant, has been named to the general administrative staff as manager of manufacturing. He will supervise manufacturing in all of the company's plants. He has been with Hyster since 1945 William H. Kilkenney will replace Woodley at the Danville plant.

JOHN R. BARTIZAL has been elected president of the Clearing Div., U. S. Industries, Inc. He returns to Clearing after an absence of about six years. Previously, he had been associated with the company for 10 years through 1954, and had served a director and executive vice president.

J. M. CROCKETT has been appointed vice president-gases of Air Reduction Sales Co. A graduate of the South Dakota School of Mines, Crockett has been associated with Air Reduction since 1945.

ROY F. COOPER, for the last thirteen years chief engineer of Sargent Engineering Corp., Huntington Park, Calif., has been appointed vice president—engineering. He is a specialist in hydraulic, pneumatic and mechanical components and systems.

Appointment of ERNEST J. PRISBE as chief production engineer of the Norris Div., Norris-Thermador Corp. at its Vernon, Calif. plant has been announced. He will supervise tooling, plant engineering and process engineering departments.

Men at Work

Lockheed has announced the appointment of BURT C. MONESMITH as corporate vice president-manufacturing, a newly established position for company-wide guidance on production functions ranging from subminiaturized electronics parts to complete aircraft and missiles. M. CARL HADDON, who has been serving as Lockheed vice president and general manager of the Electronics and Avionics Div., will become vice president and general manager of the Calif. Div. when Monesmith assumes his new duties.

Carl S. Weyandt, right, president and one of the founders of Syntron Co., has retired after more than 40 years of service. He was elected vice president general manager in 1921 and assumed the presidency in 1937. Weyandt will be succeeded by Byron K. Hartman, left, who joined the company as executive vice president and general manager in 1959.

The Metals Div., Kelsey-Hayes Co., has announced the appointment of JOHN G. ZIEMANN as chief metallurgist.

Robert H. Bruce, left, and Harvey A. Waddell, right, have been named vice presidents of Gisholt Machine Co., Madison, Wis. Bruce, now vice president in charge of sales, joined the company in 1934 and has been general sales manager since 1957. Waddell, with Gisholt since 1926, will continue to serve as treasurer and a member of the board.

The appointment of GILBERT E. PERKINS as production manager has recently been announced by the American Emery Wheel Works, Providence, R. I. JOHN N. DAVIS has been appointed plant manager of the Coated Abrasives Div., Armour Alliance Industries, Alliance, Ohio. He will be responsible for all abrasive manufacturing, quality control and industrial engineering activities. Davis was formerly division manager, Abrasives, Adhesives and Coating Div., Minnesota Mining & Mfg. Co., Canada.

FRED MAYTAG II was recently named chairman of the board and chief executive officer of the Maytag Co. He is succeeded as president by GEORGE M. UMBREIT, who had been executive vice president and treasurer.

Two new appointments within the Electric Autolite Co.'s Wire and Instrument Div. have been announced. JOHN M. GERBER has been named general manager of the division and EDWARD A. MCNALLY will be in charge of the division's plants at Port Huron, Mich., and Hazleton, Pa.

GEORGE CAMERON has joined the Acar manufacturing organization as vice president—general manager of the Acar Machine & Tool Co. affiliate in Roseville, Mich. He was director of engineering at Colonial Broach & Machine Co., Detroit, for five years.

Appointment of PAUL G. FRERER as director of engineering for Dura Corp. has been announced. He comes to the company from Cherry-Burrell Corp. where he was coordinator of engineering. Prior to joining Cherry-Burrell, he was associated with Sunbeam Corp., Chicago, as division manager, research and development. Past affiliations also include Soreng Products Corp., as vice president and director of engineering, Bendix Aviation Corp. and Friez Instrument Div.

Ray Nixon, right, formerly chief engineer of Beaver Tool & Engineering Co., has joined R-O Mfg. Co. as assistant sales director. In addition to sales activities, Nixon will head up the company's training school, which instructs customer's grinder hands in the fundamentals of R-O grinding. He will be headquartered at Madison Heights, Mich.

WILLIAM STAECKER has been named to the new position of technical director of Bliss-Henschel G. m. b. H. of Dusseldorf, West Germany. The West German firm, founded last year, is owned jointly by the E. W. Bliss Co. and Henschel-Werke G. m. b. H. of Kassel, West Germany. The organization will market the complete line of Bliss rolling mills and allied equipment, mechanical and hydraulic metalworking presses, container making machinery and other manufacturing equipment.

Donald L. Erickson, right, has been promoted to the position of production manager of Brooks & Perkins, Inc. He has been with the firm since 1946, most recently serving as chief production engineer. In his new position, Erickson will assume responsibility for production engineering, production control, purchasing and estimating.

TROUBLE-SHOOTING
THREADING PROBLEMS

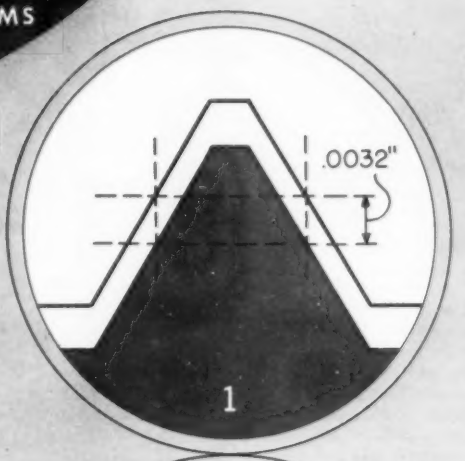
lead error

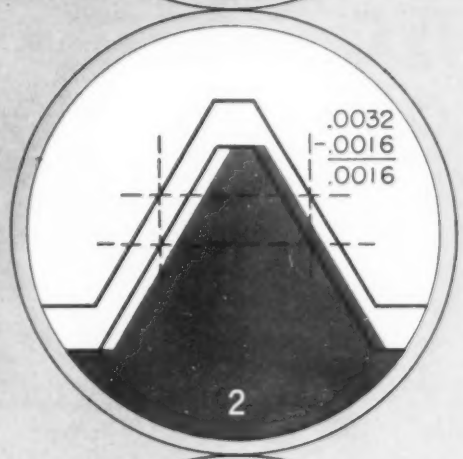
WHAT IT COSTS

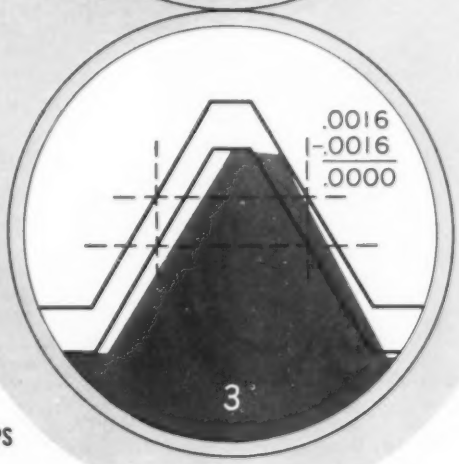
Lead error is bad enough by itself. But, when combined with other factors, it's worse. For instance, consider what happens to this 3/4-16 Class III thread.

Chart 1. shows a good thread which allows the full tolerance of .0032" on the pitch diameter for chaser wear. The same thread is shown in chart 2., but this time with a slight lead error of .0009" in 3/4 of an inch of thread length. *The working tolerance is now cut in half.* Chart 3. shows what happens when just a fifty-nine second (less than one degree) flank angle error is added to that small lead error. *There now is no working tolerance left.*

From this simple illustration, it is evident that the closer you can maintain lead and flank angle, the more size adjustment you have left for chaser wear. In other words, perfect lead and thread form present maximum provision *for better threads at lower cost.*







HOW TO PREVENT IT

Lead and thread form error are never a serious threat with J&L threading tools. Here's why:—

1.) The thread form is ground on the chaser after hardening, removing the possibility of heat-treating distortion.
2.) The thread form is ground on the exact helix angle for the diameter and pitch of thread to be cut.
3.) The non-cutting teeth on the chaser form a precision lead nut to lead on to the work.
4.) The die head has the rigidity and "beef" to hold the chasers in proper position in spite of cutting pressures.

OUR OFFER

We solve threading problems. May we tackle some of yours? Send them in—no obligation.

TANGENT & RADIAL DIE HEADS • COLLAPSIBLE & SOLID ADJUSTABLE TAPS
also
Self-opening Stud Setters • Modern-Magic Chucks and Collets
Precision Boring Machines

JONES & LAMSON

THREAD TOOL DIVISION

Jones & Lamson Machine Company, 518 Clinton Street, Springfield, Vt., U. S. A.

Field Notes

United States Rubber Co. has announced an expanded program of basic research in Europe providing for additional financial support to universities and increased contact with European scientific and engineering research activities. The company is allotting $120,000 for the support of this program. Seven universities in six countries are already receiving grants through the program and additional universities are to be added.

Universities now participating are Glasgow University, in Scotland; Imperial College of Science and Technology, University of London, England; University of North Staffordshire, England; University of Utrecht, the Netherlands; University of Liege, Belgium; University of Strasbourg, France; and Technische Hochschule, in Aachen, West Germany.

acquisitions

Clevite Corp. has announced purchase of the assets of Shockley Transistor Corp. of Palo Alto, Calif., from Beckman Instruments, Inc. William G. Laffer, Clevite president, said that the Shockley organization, headed by Dr. William Shockley, cowinner of the 1956 Nobel Prize in Physics for his work in the development of the transistor, would become a part of the corporation's Clevite Transistor Div.

Pyles Industries, Inc., of Detroit has been purchased by Kent-Moore Organization, Inc. Pyles, incorporated in 1947, is a manufacturer of complete systems for pumping and applying sealers, coatings, adhesives, paints, epoxy, foams and other catalyzed materials.

The Giddings & Lewis Machine Tool Co. has sold its Cincinnati plant to The Cincinnati Milling Machine Co., according to an announcement made by Ralph J. Kraut, president. The transaction involved real estate only and did not include the product line of Giddings & Lewis/Bickford radial and upright drilling machines manufactured in Cincinnati.

Shim facilities of **National Seal Div.**, Federal-Mogul-Bower Bearings, Inc., Redwood City, Calif., have been acquired by the Laminated Shim Co., Inc., of Glenbrook, Conn., according to a joint announcement by A. V. Anderson, president of Laminated Shim, and Milton Bulkeley, general manager of National Seal Div. All of the National Seal shim equipment is being moved to Connecticut, and production of some items will begin immediately.

expansions

David Karr, president of **Fairbanks Whitney Corp.**, has announced that a second major subsidiary, the 100-year-old machine tool manufacturing firm of Pratt & Whitney Co., Inc., has been brought into the parent company's international expansion program through special sales and product contracts with two outstanding European toolmakers, Alfred Herbert Ltd., of Coventry, England, and Les Innovation Mechaniques, of Moretsur-Loing, France. The contracts were negotiated in England and France by J. J. Jaeger, president.

Facilities for production of thermocouple and other pyrometer supplies have been expanded by **Minneapolis-Honeywell's Brown Instruments Div.** Operations in Philadelphia, principal manufacturing center for the company's industrial process instrumentation, have been streamlined and moved to new quarters.

Hitemp Wires, Inc., a producer of high temperature insulated wires, cables and cable assemblies, has increased its production capacity 25 percent with the opening of an integrated manufacturing facility in Monrovia, Calif. The new plant is operated by Hitem, Inc., a newly formed, wholly owned subsidiary.

E. F. Houghton & Co. has opened a new plant at 54 Tanforan Ave., South San Francisco, Calif. Industrial oils and chemicals formerly manufactured at Houghton's plant at 1500 Davidson Ave., San Francisco, are now being supplied from this facility. Newly installed equipment includes provision for sulphonation, saponification, compounding, esterification and condensation reactions. Capacity has been increased more than 50 percent over that of the former plant.

new facilities

Establishment of a new computer laboratory within the engineering department of **National Broach & Machine Co.**, Detroit manufacturer of gear-production equipment and broaching tools, has been announced by Walter S. Praeg, president. The company will utilize electronic digital computer equipment, in the design of gear-shaving cutters, gear-honing tools, master gears and broaching tools. Extensive analytical work on the design of gears and splines and related tooth shapes will also be carried out.

A new ultrasonic immersion testing facility, one of the first of its kind installed by a specialty steelmaker, has been placed in operation at Standard Steel Works Div. of **Baldwin-Lima-Hamilton Corp.** The $25,000 facility, an important addition to Standard's extensive equipment for quality control, is used to test for tiny internal flaws in extremely high-quality thin-section and complex-section steel shapes.

A new plant to serve East Coast industry will be built at North Haven, Conn., by **Linde Co.**, Div. of Union Carbide Corp. Ground will be broken for the new plant in May, and completion is scheduled for Dec., 1960.

moves

The American Emery Wheel Works of Providence, R. I., manufacturers of a complete line of grinding wheels and abrasives, have recently announced the removal of their Detroit district offices and warehouse to Warren, Mich. The new office spaces and increased warehousing facilities are in keeping with current expansion policy and will enable the company to provide better service to its Michigan accounts.

Moving of the **Parker-Hannifin** field sales office from 210 Main St., Hackensack, N. J., to new, larger quar-

ters at 19 Railroad Ave., Emerson, N. J., is announced by Richard E. Hitchcock, regional manager.

awards

An annual competition offering $1000 in cash prizes for the best new or projected uses for bronze or brass castings has been announced by the **Brass & Bronze Ingot Institute.** Purpose of the competition is to encourage sound, progressive and creative use of brass and bronze castings in industrial, architectural, and consumer products.

James F. Fairman, senior vice president, Consolidated Edison Co. of New York, has been selected to receive the 1960 National Society of Professional Engineers Award for outstanding service to the engineering profession. Formal presentation of the Award will be made at a banquet session at the National Society's annual meeting in Boston, Mass., June 11.

Edward T. Vincent, professor emeritus of mechanical engineering at the University of Michigan, has been awarded a Certificate of Achievement by the Army. The award was presented in recognition of Vincent's contributions to the field of soil-vehicle mechanics.

Six men widely known in engineering and industry, three of them leaders in Wisconsin industry and four of them graduates of the **University of Wisconsin,** have been cited for outstanding accomplishments in their fields at the 12th annual Wisconsin Engineers' Day celebration. The six leaders recommended for distinguished service citations by the UW College of Engineering faculty and Pres. Conrad A. Elvehjem, are: Robert C. Allen, director of engineering, industries group, Allis-Chalmers Mfg. Co., Milwaukee; Alexander G. Christie, emeritus professor of mechanical engineering, Johns Hopkins University, Baltimore, Md.; Ronald E. Copeland, director of engineering, National Concrete Masonry Association, Chicago, Ill.; Clifford C. Gladson, executive vice president and member of the board of directors of the Ladish Co., Milwaukee; William A. Klinger, president of W. A. Klinger, Inc., construction firm, Sioux City, Iowa; and Lynn H. Matthias, vice president in charge of research, the Allen-Bradley Co., Milwaukee.

Alvin M. Weinberg, director of Oak Ridge National Laboratory, has been named one of four recipients of the Atoms for Peace Award. Granted for the first time to American scientists, the award for 1959 is shared by Eugene P. Wigner, former research director of ORNL and presently professor of mathematical physics at Princeton University, and by Leo Szilard, professor of biophysics, the University of Chicago.

The award for 1960 is shared by Mr. Weinberg and W. H. Zinn, vice president of Combustion Engineering, Inc. The recipients were recognized for their leadership in reactor development. Formal presentation of awards was made at the National Academy of Sciences in Washington May 18.

association news

E. W. Barnwell, Apex Corp., Roseville, Mich.; David J. Bathgate, Oval Tool & Die Corp., Detroit; and William J. Fortin, Pamco Co., 33300 Grosebeck Highway, Fraser, Mich., have all been named to important posts on committees of the **National Tool & Die Manufacturers Association.** Barnwell, treasurer of the national association, will also

serve as chairman of the Government Relations Committee. Bathgate becomes chairman of the Awards Committee, while Fortin has been appointed vice chairman of the Apprentice Training Manual Committee of the national association.

The Phillips Petroleum Co. has been selected to receive the first annual Industrial Professional Development Award of the National Society of Professional Engineers. The Award, an engraved plaque, will be presented at the annual meeting of the 52,000-member engineering group in Boston, June 8-11.

James E. Newsome was elected national president of the **Society for Advancement of Management** today, at the annual meeting of the Society's board of directors. Newsome, production manager for the Chicago, Ill., plant of Johnson & Johnson, succeeds Dause L. Bibby, executive vice president of Remington Rand, who was elevated to the post of S.A.M. board chairman.

new activities

The Budd Co. has acquired the assets of Metrol Inc., manufacturers of electromagnetic nondestructive testing equipment with headquarters in Pasadena, Calif. The announcement was made by Dr. John H. Buck, vice president and general manager of the Instruments Div. of The Budd Co. Purpose of the acquisition is to expand the division's nondestructive testing equipment line.

The appointment of **The Ray W. Pratt Co.** of Cincinnati, as exclusive sales representative in southwestern Ohio is announced by Samuel Arvy, president of Michigan Machine & Broach Co., Detroit. Staffed by graduate engineers, the Pratt Co. is well-known as an engineering consultant to the metalworking trade.

In a move aimed at expanding its services to the packaging industry, **Aluminum Co. of American** has announced creation of a packaging development laboratory. Ross C. Reed has been named manager of the new operation.

Ferracute Machine Co. of Bridgeton, N. J., has announced the appointment of two new distributors. In the state of Missouri and the southern part of Illinois, the complete Ferracute line of presses, press brakes and special machinery will be represented by Continental Machinery Sales Co., 2120 S. 7th St., St. Louis 4, Mo. The entire state of Oklahoma will be covered by Industrial Machine & Tool Co., 615 N. Sheridan Rd., Tulsa, Okla.

Dr. Julius London, associate professor of meteorology at New York University's College of Engineering, has received a contract renewal from the United States Air Force Cambridge Research Center to continue research in satellite meteorology. The extension provides for funds to July of 1961 at the rate of $20,000 a year.

The research project is concerned with the distribution of heat radiation from the earth and its atmosphere that would be observed by specially equipped meteorological satellites, such as Turos I, launched April 1 at Cape Canaveral.

A design study for a nuclear reactor at **Picatinny Arsenal,** near Dover, N. J., was awarded recently to Allis-Chalmers and Vitro Engineering Co. by U. S. Army Ordance Corps. The study will be the first step in a program aimed at designing and building a 20-30,000 kw nuclear research and materials-testing reactor for use by the Picatinny Arsenal staff and other U. S. Army Ordnance Corps agencies.

Seibert & Sons, Inc., Chenoa, Ill., manufacturer of production holding tools, tool control boards, and spindle equipment, has opened a Detroit factory branch office at 18926 Schoolcraft, and has moved its warehouse to this same location. Staffed to furnish complete information and warehouse service on Seibert Products, the operation is under supervision of Dennis P. McCormick.

ENGINEERING BOOKSHELF

WORK IMPROVEMENT—*By Guy C. Close, Jr. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $7.75. 388 pages.*

Understanding people is the primary requisite for planning and implementing work improvement policies. The author relates effectively the nature of humans to the goals of an organized approach to work improvement. Rather than an industrial treatise, the book is broad in scope to encompass office and service organizations as well as industrial plant. This appears to have an advantage in that it sets the reader to thinking in more general and thus more creative terms.

The book is divided into five main parts. The first part is meant to build a proper mental climate for and approach to cost reduction, the goal of work improvement.

The methods of selection and definition of the problems to be solved are considered in part two.

The third part gives instructions in the use of the various analytical tools available to record and study the details of the problem.

Principles and methods of the creative activities are explained in part four. The last part sets forth ways and means of getting action on the selected method or application.

ACCIDENT PREVENTION MANUAL FOR INDUSTRIAL OPERATION—*Published by the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill. Price $15.50 (less for quantity orders). 1542 pages.*

This book, the fourth edition, is a must for all persons charged with maintaining industrial safety on any level. The manual describes how to get employees safety oriented as well as describing hazards and precautions.

Subjects covered in the manual include: accident investigation; analysis and costs; plant construction and maintenance; handling and storage of

materials, power trucks and tractors; ropes, chains and slings; hand and power tools; flammable liquids; personal protective equipment; medical, nursing and first-aid services in industry; and a table of chemical hazards.

New chapters in this edition are: hazards of handling radioactive materials, nondestructive means of testing materials and products through radiography, and various kinds of radiation and safe limits of exposure.

HOW TO DESIGN AND BUY INVESTMENT CASTINGS—*Edited by Robert H. Herrmann. Published by Investment Casting Institute, 27 E. Monroe St., Chicago 3, Ill. Price $3.95. 161 pages.*

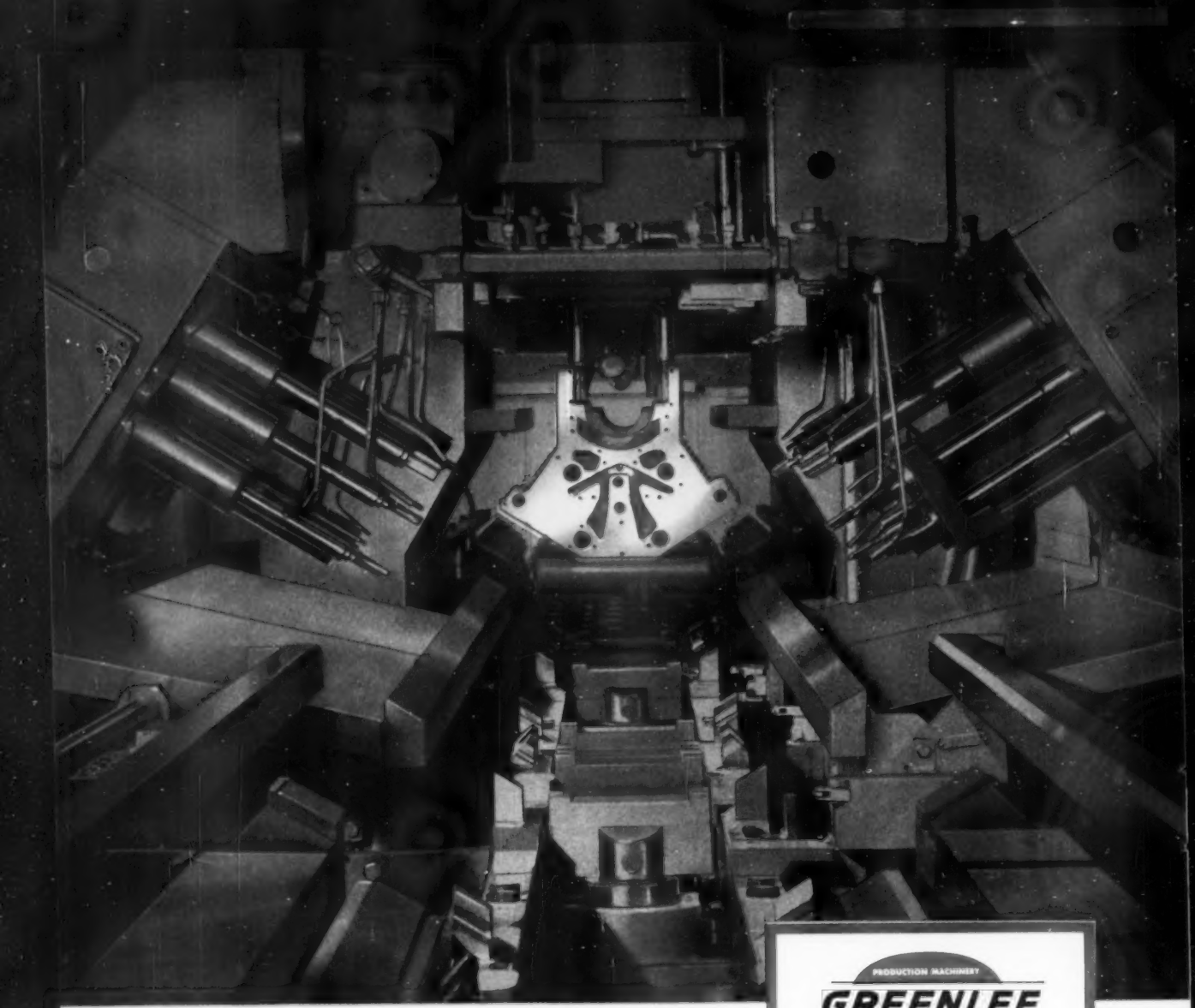
Investment casting has become a valuable method to combat high costs of production of complex metal parts. It has especially found wide use in application to high-temperature, hard-to-machine alloys. This book outlines the capabilities of investment casting and details elements of the process. Design of castings is discussed in a manner to help realize the most economy from the process.

The book is divided into seven chapters which give coverage to such areas as: advantages of the investment casting process; basic production techniques; choice of alloys; and how to buy investment castings. The book includes ICI specifications for investment casting alloys, and an alloy selection chart. The book also includes standards for design tolerances and standards for inspection and surface finish.

VACUUM PROCESSING IN METALWORKING—*By J. Wesley Cable. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $5.50. 202 pages.*

Relatively new in terms of commercial application, the field of vacuum technology receives a practical treatment in this book. The first few chapters cover the general phases of vacuum technology, such as the means of producing low pressures and their measurement. The remaining chapters are each devoted to a particular phase of vacuum processing. The book includes discussion on subjects such as vacuum melting techniques degassing of metals, and the metallurgical applications of vacuum processing to powdered and electronic materials, coatings and high-temperature alloys.

In general, the book presents vacuum technology in a descriptive manner rather than in a highly technical form.



it took 35 seconds and 52 years to process this Diesel engine block

And 52 years? Yes, that's how long Greenlee has been building automatic transfer machines. In these years we have helped solve hundreds of widely diversified problems in automatic production. This experience has won exceptionally wide recognition in the automotive industry. That's why much of our business is repeat business from satisfied customers. If you haven't yet worked with us, now is the time to call. We stay on the job all the way . . . from the time of initial planning until the machine is operating at full efficiency.

PRODUCTION MACHINERY

GREENLEE

- Transfer-Type Processing Machines
- Multiple-Spindle Drilling and Tapping Machines
- Six and Four-Spindle Automatic Bar Machines
- Die Casting Machines
- Trim Presses
- Woodworking Machines and Tools
- Hydraulic and Hand Tools

GREENLEE BROS. & CO. 1909 MASON AVE. ROCKFORD, ILLINOIS

Use Reader Service Card, CIRCLE 115

Use THESE HANDY FORMS

to obtain more FREE

INFORMATION

about Products covered

in this issue of

The TOOL ENGINEER

Circle KEY NUMBER —each item carries a Key Number.

Print clearly your name, title, firm name, product manufactured and your address.

NO POSTAGE REQUIRED

Copies of Technical Articles are available upon written request —as long as the supply lasts.

FIRST CLASS
PERMIT NO. 10782
DETROIT, MICH.

BUSINESS REPLY MAIL
No postage stamp necessary if mailed in the United States.

The TOOL ENGINEER

10700 Puritan Avenue

Detroit 38, Michigan

June 1960 *For More FREE* **INFORMATION** *Circle Number*

Name..... Title.....

Company..... Product.....

City..... Zone..... State.....

1	18	37	56	75	94	113	132	151	170	303	322	341	360	379	414	433	452
2	19	38	57	76	95	114	133	152	171	304	323	342	361	380	415	434	453
3	20	39	58	77	96	115	134	153	172	305	324	343	362	381	416	435	454
4	21	40	59	78	97	116	135	154	173	306	325	344	363	382	417	436	455
4-A	22	41	60	79	98	117	136	155	174	307	326	345	364	383	418	437	456
5	23	42	61	80	99	118	137	156	175	308	327	346	365		419	438	457
6	24	43	62	81	100	119	138	157	176	309	328	347	366	401	420	439	458
7	25	44	63	82	101	120	139	158	177	310	329	348	367	402	421	440	459
7-A	26	45	64	83	102	121	140	159	178	311	330	349	368	403	422	441	460
8	27	46	65	84	103	122	141	160	179	312	331	350	369	404	423	442	461
9	28	47	66	85	104	123	142	161	180	313	332	351	370	405	424	443	462
10	29	48	67	86	105	124	143	162	181	314	333	352	371	406	425	444	463
11	30	49	68	87	106	125	144	163	182	315	334	353	372	407	426	445	464
12	31	50	69	88	107	126	145	164	183	316	335	354	373	408	427	446	465
13	32	51	70	89	108	127	146	165	184	317	336	355	374	409	428	447	466
14	33	52	71	90	109	128	147	166	185	318	337	356	375	410	429	448	467
15	34	53	72	91	110	129	148	167		319	338	357	376	411	430	449	468
16	35	54	73	92	111	130	149	168	301	320	339	358	377	412	431	450	469
17	36	55	74	93	112	131	150	169	302	321	340	359	378	413	432	451	470

INSIDE FRONT COVER **INSIDE BACK COVER** **BACK COVER**

Where more than one catalog or product is featured, indicate the key number and product information preferred: Key No. ..... Product.....

USE THESE HANDY FORMS

to obtain more FREE

INFORMATION

about Products covered

in this issue of

The TOOL ENGINEER

June 1960 *For More FREE* **INFORMATION** *Circle Number*

Name..... Title.....

Company..... Product.....

City..... Zone..... State.....

1	18	37	56	75	94	113	132	151	170	303	322	341	360	379	414	433	452
2	19	38	[illegible]	76	95	114	133	152	171	304	323	342	361	380	415	434	453
3	20	39	[illegible]	[illegible]	96	115	134	153	172	305	324	343	362	381	416	435	454
4	21	40	[illegible]	78	97	116	135	154	173	306	325	344	363	382	417	436	455
4-A	22	41	[illegible]	79	98	117	136	155	174	307	326	345	364	383	418	437	456
5	23	42	61	80	99	118	137	156	175	308	327	346	365		419	438	457
6	24	43	62	81	100	119	138	157	176	309	328	347	366	401	420	439	458
7	25	44	63	82	101	120	139	158	177	310	329	348	367	402	421	440	459
7-A	26	45	64	83	102	121	140	159	178	311	330	349	368	403	422	441	460
8	27	46	65	84	103	122	141	160	179	312	331	350	369	404	423	442	461
9	28	47	66	85	104	123	142	161	180	313	332	351	370	405	424	443	462
10	29	48	67	86	105	124	143	162	181	314	333	352	371	406	425	444	463
11	30	49	68	87	106	125	144	163	182	315	334	353	372	407	426	445	464
12	31	50	69	88	107	126	145	164	183	316	335	354	373	408	427	446	465
13	32	51	70	89	108	127	146	165	184	317	336	355	374	409	428	447	466
14	33	52	71	90	109	128	147	166	185	318	337	356	375	410	429	448	467
15	34	53	72	91	110	129	148	167		319	338	357	376	411	430	449	468
16	35	54	73	92	111	130	149	168	301	320	339	358	377	412	431	450	469
17	36	55	74	93	112	131	150	169	302	321	340	359	378	413	432	451	470

INSIDE FRONT COVER INSIDE BACK COVER BACK COVER

Where more than one catalog or product is featured, indicate the key number and product information preferred: Key No. ..... Product.....

Circle KEY NUMBER —each item carries a Key Number.

Print clearly your name, title, firm name, product manufactured and your address.

NO POSTAGE REQUIRED

FIRST CLASS
PERMIT NO. 10782
DETROIT, MICH.

BUSINESS REPLY MAIL
No postage stamp necessary if mailed in the United States.

The TOOL ENGINEER

10700 Puritan Avenue

Detroit 38, Michigan

Copies of Technical Articles are available upon written request —as long as the supply lasts.

.....readers' viewpoints

. . . thread gaging

To the Editor:

We are looking for information in regard to a tool for checking tapped holes. Each part to be inspected has approximately 15 tapped holes ranging in size from 3-48 to 6-32. To inspect these holes with conventional plug gages, as we are now doing, is an extremely expensive operation.

The tool we are looking for would be approximately the size of a small hand grinder. It would be equipped with a reversible motor with a torque adjustment. The tool could work on either air or electricity.

We have investigated a number of larger machines of this purpose but we find them too rigid and difficult to hold in relation to the thread gage.

If you know of any company which manufactures a tool for this purpose, we would appreciate your sending us its name and address.

Rolland F. Goodsell
Chief Parts Inspector
Groton Plant
Smith-Corona Marchant, Inc.

We know of no company which manufactures such a tool. Possibly there are ASTME members who have had similar problems. If so, we'd be interested in their solutions.—Ed.

. . . weight calculation

To the Editor:

In the March issue of THE TOOL ENGINEER, I found an extremely useful article on the subject of weight calculation by James H. Dodge [Weight of Bar Stock is Quickly Calculated, by James H. Dodge.]

Some years back I had a problem involving calculation of weight of bar stock. The formula I used for round steel bars was:

$$W = 2.666\ d^2$$

where W equals weight in pounds per foot-length and d equals bar diameter in inches.

In calculating weight of flat steel bars my formula is:

$$W = 3.4\ wt$$

where w equals bar width in inches and t equals bar thickness in inches.

Readers of THE TOOL ENGINEER may possibly find this information useful as a supplement to Mr. Dodge's article.

A. C. Bhattacharya
Asst. Production Engineer
Eastern Railway (India)

Tech Digests

Metalworking Lubricants

By Lawrence C. Hays
Engineering Specialist
Reliability Group of
Advanced Engineering Dept.
Thompson Ramo Wooldridge Inc.
Cleveland, Ohio

THE TYPE of operation to be performed usually determines the type of cutting fluid and characteristics desired. Grinding, for example, requires two basic types of cutting fluids: fluids with high e.p. characteristics for form, thread and other similar operations; and, fluids with good cooling properties for surface, cylindrical and similar operations. Water-base fluids should be used on grinding operations wherever possible because of misting problems with oil which often require expensive precipitation equipment.

Some operations require that the cutting fluid also serve as the lubricating medium for the machine tool. This requirement limits the type, viscosity and characteristics to those that are compatible with the machine requirements. Irreparable damage to a machine tool could result if a fluid were too active chemically, too viscous and/or too diluted with water.

Extreme care must be exercised in applying cutting fluids to operations where there is danger of bearing failures and other malfunctions due to fluid leaking through worn seals. Soluble oils and chemical compounds usually have greater wetting capacity than do straight oils and, therefore, tend to leak through seals that would normally seal out oil. A small amount of oil seal leakage with straight oils can often be tolerated, but with water solutions serious trouble can develop and hydraulic and lubricating systems can be contaminated. In many cases the cost of seal replacement and maintenance is too high to justify economically the use of water solutions.

One aspect of cutting fluid application that requires careful attention is disposal after use. Straight oils can usually be salvaged and sold or reclaimed. Soluble oils and chemical compounds are generally not worth reclaiming and, in most localities, ordinances prohibit dumping these solutions. An additional expense may be thereby incurred in installing, or to have contracted, treatment plants to break down the solutions.

Many practical problems can arise through the use of cutting fluids. The use of fluids that tend to foam excessively should be restricted unless suitable foam inhibitors can be used. Some cutting fluids tend to form gum, while others may cause excessive smoke or fumes. A water base fluid may cause rusting if the fluid is too dilute and/or not properly inhibited against rust. Some cutting fluids may or be conducive to operator dermatitis unless strong germicides are used. The problem of dermatitis can be reduced by operator education in preventive hygienic measures such as careful washing of exposed areas and the use of a suitable ointment.

Functions of Cutting Fluids

On many operations the main purpose in using a cutting fluid is to cool the tool, chips and machine tool. Many persons in the field refer to cutting fluids as coolants because of this function. Cooling is only one of several functions possible with cutting fluids.

On some operations the use of a cutting fluid detracts from tool performance and the operation is best performed without a cutting fluid. Carbide tools, for example, are often damaged by intense heating and cooling such as obtained on high-speed milling operations. Each tooth of the cutter is heated during cutting and is immediately quenched after leaving the point of contact. This causes quenching cracks to develop on the carbide and tool failure may occur. If this condition exists (and it is more prevalent with dilute water base fluids than with straight oils), the percent water in the solution can be reduced, the fluid can be replaced with one with less cooling ability or the use of a fluid can be eliminated. The intent in each case is to reduce the cooling of the tool.

There are other avenues of attack to reduce or eliminate tool cracking, as described, but these are in the category of tooling as opposed to cutting fluids. Tool geometry, tool material, feed speed, type of cut and other variables should, of course, be part of any concerted effort to improve production and reduce costs. Tools can also be damaged because of insufficient cutting fluid. This causes sporadic cooling and results in cracking of the carbide.

Application of cutting fluids to operations should be done with reasonable care. Use sufficient size pumps to give adequate flow, and arrange the piping so that the fluid flows into the cutting zone instead of on the machine ways, sump, guards and other areas not benefitted by the fluid.

Many times a machine tool may be expertly designed, the tooling may be excellent, but the results are not as good as expected because of inadequate fluid flow or misdirected flow. For example: on one particular form grinding application, four cutting fluid nozzles brought about a considerable decrease in burning of the ground parts and permitted a sizable increase in production rate.

Selecting Cutting Fluids

The condition of the machine tool can play an important part in cutting fluid selection. For example, two different cutting fluids can be required for two similar machines performing the same operation with the same tooling and machining variables. Bearing fits, gib fits, condition of ways and other variables can be sufficiently different between machines to necessitate different

cutting fluids to be used.

Some metals for machining are manufactured with friction reducing compounds added to the metal during the melting process. In this case you might say that the cutting fluid was built into the metal. The free machining brasses and automatic screw machine stocks have additions of sulphur to reduce friction at the tool point and between the chip and tool. Lead pellets are also added to steel as an internal lubricant. With the free machining metals, cutting fluids can be used for cooling and additional lubrication.

Evaluation of Cutting Fluids

Cutting fluid evaluation presents an interesting and formidable challenge. Many pitfalls must be avoided if the results attained are to be worthy of the time and money expended in attaining them. Laboratory research on controlled testing is the most satisfactory method of comparison and evaluation but cost plays an important part. Many companies cannot afford to set up laboratory machining and grinding machines strictly for cutting fluid tests.

The next approach is to use production machines, but closely supervise testing. This again is somewhat costly and out of the question for smaller companies. Cutting fluids can also be evaluated on production machines without close supervision, but the results are generally clouded with data omissions, personal opinions and other defects.

Dependence upon machine operators to supply answers to cutting fluid performance is leaving too much to chance. His opinions may be biased because of personal preferences as to color, odor and others. In general, it may be stated that unsupervised cutting fluid evaluations are not satisfactory.

The testing of cutting fluids is complex at best so all measurable factors must be controlled or evaluated to give satisfactory solutions. Data sheets should be developed for cutting fluid evaluations to record all pertinent data. These should be numbered and filed for reference and comparison with subsequent tests.

Should you buy cutting fluids by specifications? This question arises many times in industry and cannot be answered with a "yes" or "no." The best answer is, "If you can afford the expense of checking specifications, you can't afford not buy to on specification." The cutting fluid producers can supply you with quality fluids, but you have no assurance that their specifications will stay as originally supplied unless you have facilities or can afford outside laboratory expense to check the fluids.

A cutting fluid supplier can furnish an exceptionally good fluid for test and supply a cheaper and less efficient fluid for subsequent purchases. By normal production evaluation methods, this may be difficult to determine, until production figures have been computed at a later date.

Suppliers can also alter their own brand name materials, as a result of their tests or tests in other plants. The altered material may have the same code name or number as that previously furnished, but may have considerable variations in the principal constituents. Unless you can specify and test that the specifications are being met, you can never be sure of getting the same material each time. Trade name purchasing has another serious drawback in that only one source of supply is available and in times of short supply, no identification is available for obtaining a similar product to do the work.

How Fluids Perform

The mechanics of how cutting fluid penetrates between the chip and tool, and tool and work, has not been clearly defined. Earlier experimenters thought they detected a split at the junction of the chip and tool. This would be very convenient for it would permit cutting fluid to penetrate easily to the tool edge. Actually, such a split does not exist.

At low speeds there is ample evidence that the cutting fluid does help to reduce friction between the chip and tool, and tool and work. As the cutting speed is increased, the friction reducing property of the fluid becomes less important and cooling becomes more important.

At high cutting speeds, and with continuous cuts, either the reaction time between the lubricant and work, and/or tool material, is slower than the speed of the operation, or little or no cutting fluid penetrates the tool chip interface because very little lubrication can be noted.

Another contributing factor is the fact that as speed is increased, a smoother cut surface is produced due to a decrease in the built-up edge on tools and there is less need for lubrication. The built-up edge forms on the tool point because of high friction between the chip and tool and becomes an auxiliary cutting point. On operations with multitooth cutters, such as milling cutters and grinding wheels, a small amount of cutting fluid will be carried into the cutting zone on each tooth or cutting point. On form-grinding, for example, oils with moderately high viscosity and extreme pressure characteristics show large increases in grinding performance over water soluble fluids and oils with less desirable characteristics.

Modern mass production companies use cutting fluids on all operations where it is possible to do so. Water base fluids are used on those operations where cooling is the main problem, and straight oils where lubrication is the main problem.

High-speed machining chips are a serious problem because of their velocity and heat but the problem can be solved partly by the use of cutting fluids with high cooling properties. Cooling of chips also promotes better chip control by quenching the chips and making them break into small segments instead of long continuous coils.

Mist cooling, with water-base fluids

applied under the tool at the point of contact, can often improve performance over conventional flooding methods. This permits location of the nozzle below the tool; whereas, with conventional flooding methods, this is generally undesirable because of excessive splashing. For mist cooling, about one quart of fluid per hour is required. Carbon dioxide spray applications have had limited success, especially on difficult grinding operations.

Every operation, of sufficient size to justify the cost, should be continuously evaluated for possible improvement as part of a continuing cost reduction program. Tools, tool materials, fixturing, feeds, speeds, cutting fluids and other variables should be evaluated. It is neither desirable nor necessary to have a separate cutting fluid for each operation, nor should one cutting fluid suffice for all operations.

Somewhere between these two extremes is a happy medium. The best solution to the problem is to run comparisons between competitive fluids to determine the best fluid or fluids for each operation. One fluid might be superior in performance to another fluid and still not be adopted because of costs, including original and stocking cost. Small quantity buying can often change the difference between cutting fluids by the price differential penalty on small orders.

There are isolated cases of operations where only one to two cutting fluids could be used and a standard fluid for other operations could not be applied. In these cases, a special fluid is warranted. Where economically feasible, central systems should be installed to combine the cutting fluid systems of machines doing the same or similar operations.

Testing Procedures

In testing a cutting fluid for a particular operation, the severity of each tool in the operation must be taken into consideration in the final selection. If, for example, more than one tool is in the operation, selection of the proper cutting fluid must be directed toward the tool needing the most help.

A dilute, soluble-oil water solution would be unsatisfactory for tapping steel and, on the other hand, a tapping oil is not required for turning. If both tools were used on an operation the cutting fluid selection would have to favor the tapping.

Much of the success or failure of cutting fluid applications can be attributed to the use or lack of common sense. Improper fluid flow and direction, not maintaining water to base percentage, poor housekeeping and other faults can nullify a good cutting fluid program. Maintenance of the cutting fluid phase of manufacturing is just as important as proper maintenance of tools and machines.

Cutting fluids must not be taken lightly or treated as a necessary evil. They are a part of the manufacturing team and require proper attention. Storage, use and disposal of cutting fluids must be set up in an orderly and correct manner in order to realize the most benefit from them.

Cutting fluid studies should be carefully made so that:

1. Operations with defective machines and tooling can be avoided. Any differences in performance between cutting fluids will be lost in set-up errors
2. Operator cooperation can be expected. If the operator feels the study will help his position, he will cooperate
3. Machines and operations, where operator technique does not play an important part in the success or failure, can be selected
4. Operations with erratic tooling can be avoided.

Measurement of cutting fluid performance depends upon the type of operation and desired result. If surface finish is the controlling variable, then obviously the cutting fluid giving the best surface finish is the fluid desired. If, however, production (or production rate) is the controlling variable, then the cutting fluid giving the highest production will be the fluid desired.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Cutting fluid performance can be based upon:

1. Tool life
2. Production rate
3. Surface finish
4. Size control
5. Chip formation

Cutting fluid performance will vary with the machining conditions used. For example, a slight increase in feed may reduce tool life but increase production rate. By increasing feed and speed, greater production rate can often be attained with little change in surface finish. A word of caution here! Be careful in evaluating cutting fluids un-

der one set of test conditions and assuming the same results will be obtained with different cutting conditions.

A superior fluid at low speed may be inferior at higher speed, and a fluid that is superior on one operation, or machine, may be inferior on another operation or machine. The material being machined can also vary the expected results.

Variations in heat treatment can vary the rating of cutting fluids on comparison tests. As an example—machinability tests showed that on large grain 1045 steel, dry machining was superior to a soluble oil, whereas, on fine grain 1045 steel, soluble oil was superior to dry cutting.

Testing and use of cutting fluids covers more than rating of cutting performance. Other important factors such as smoking, foaming, dermatitis, odor and rusting must also be evaluated. It is difficult to divorce these factors from actual performance evaluations and any negative qualities will detract from the over-all rating.

Many attempts have been made to devise a simple, inexpensive method of evaluating cutting fluids that approximates actual machining conditions. To date, the attempts, for the most part, have all been unsuccessful.

In order to evaluate satisfactorily cutting fluid performance, some form of machining operation must be used. Results of one machine operation can sometimes be applied to similar operations. However, care must be exercised in taking results of one operation and applying them to quite dissimilar operations. The relative rating of two cutting fluids can often be reversed by changing to a different type of machining operation, tool material and/or work material. Changes in the cutting conditions, such as increasing or decreasing the speed and feed can also reverse the rating of two fluids.

The amount of additive or chemical elements does not necessarily bear a direct relation to the expected performance. Chemical activity can play an important part in whether a particular cutting fluid is satisfactory or not. With some metals, high-chemical activity is needed, while little or no chemical activity is required with others. As an example: titanium requires a cutting fluid for grinding that can reduce the reaction between the titanium and the grinding wheel. Titanium becomes very active at high temperatures and poor grinding will be the result. With the right amount of chemical compounds and the desired chemical activity,

grinding titanium becomes much more satisfactory.

It is also possible to have chemical additives that are too active. In this case, tool life or grinding wheel life may be seriously reduced by the chemical action.

Based on a lecture delivered at Ryerson Institute of Technology, Toronto, Ontario, Canada.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Material and Structural Damping for Vibration Control

In former years resonance conditions could often be avoided by properly controlling the natural frequencies in a system, that is by adjusting the stiffness and mass factors in the structure such as to safely separate the natural and the exciting frequencies. However, this approach is no longer effective in many situations, particularly in aero-space vehicles, because an excessive weight penalty is often involved. Furthermore, random excitation, either of mechanical or acoustical origin, is becoming more prevalent in service. For example, the typical noise spectrum for a jet engine contains a range of frequencies which is wide enough to encompass most of the resonance frequencies encountered in an aircraft structure. Thus, whatever the natural frequency of the structural components and assemblies may be within this wide range of frequencies resonant vibrations can still be excited.

Experiences in recent years have made it abundantly clear that resonant vibrations can no longer be avoided by clever design. Thus, modern structures, particularly aero-space vehicles, must be so designed as to withstand the resonant excitations characteristic of service. This paper is concerned with the factors involved in (a) the analysis of resonance amplification, (b) the fatigue stress associated with this condition (resonance fatigue), and (c) the importance of damping in the design of structures for high resonant fatigue strength. Since the factors important in conventional fatigue strength (stress concentration, loading range, etc.) are amply covered in other papers, this paper shall be concerned with only those factors which are of unique interest in resonance fatigue.

Based on Paper No. 100U, by B. J. Lazan, U. of Minn. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

the
complete
line

Butterfield drills are a complete, expertly made line in themselves. So are all other cutting tools in *the* complete, top-quality Butterfield line: drills, reamers, taps, dies, counterbores, cutters, end mills, hobs and carbide tools. Phone for quick deliveries or technical aid. Warehouses in Chicago, Detroit, Fort Worth, Los Angeles, New York and San Francisco. **Call your Butterfield Distributor.**

BUTTERFIELD

DIVISION, Union Twist Drill Company, Derby Line, Vt.

36B.0.8

technical shorts

Contoured All-Metal Honeycomb

Allied Research & Engineering Div. of Los Angeles has announced development of contoured all-metal honeycomb for use in aircraft, missiles, space vehicles and radar applications. The new process makes it entirely possible to build all-metal contoured honeycomb structures with any number of shapes or curves and in almost any size. Generally, there is no limit to radius of curvature nor is there any dimensional restriction on location of compound curves. This flexibility will enable designers to specify honeycomb of any configuration.

Successful Synthesis of Diamonds

Norton Co., Worcester, Mass., has successfully synthesized diamonds and has applied for patents on its process and equipment. Norton's active interest in synthetic diamonds began in the early 40's when it supported a project to investigate effects of high pressure and temperature on carbon. This project was carried out under the direction of Prof. Percy B. Bridgeman, Nobel Prize winner and professor of physics at Harvard University's School of Engineering. This project was concluded in 1946.

The current project which led to successful synthesis of diamonds was concluded at the company's laboratories.

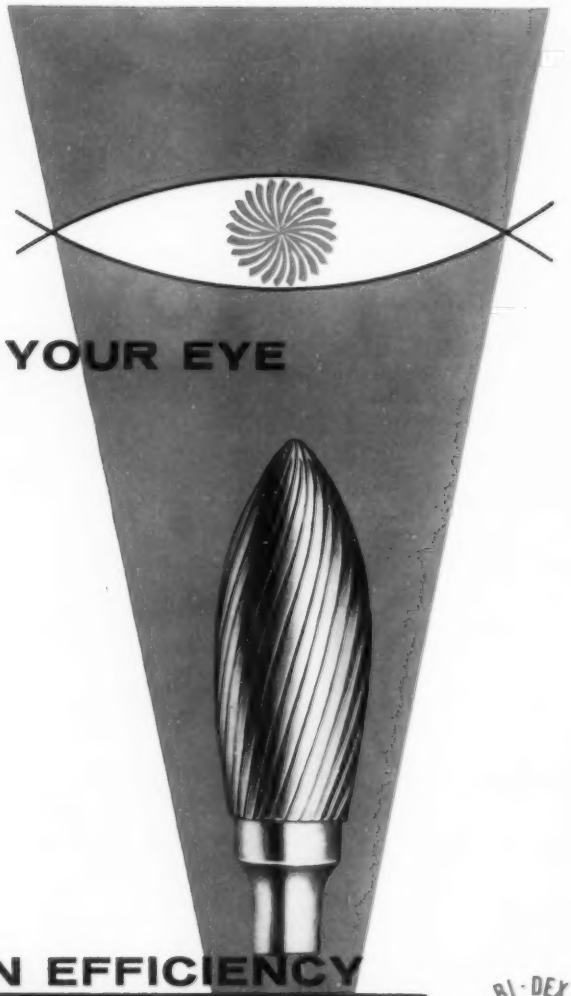
Low-Temperature Metal Bonding

Advances in diffusion welding now make it possible to obtain excellent bonds at temperatures as low as 650 F, metal joining specialists at Batelle Memorial Institute report. The new method, related to conventional forge welding, involves the use of one or more intermediate metals to join the base material. These metals are ones which usually can be applied by plating.

Use of intermediate metals makes it possible to weld joints at temperatures far below those normally required for pressure bonding. In some cases the intermediate metals reduce or eliminate deformation during bonding operations.

Diffusion bonding processes have been applied to a number of problems at the Institute. One application was in development of a method of making a throat block for a high-speed wind tunnel out of Monel metal and beryllium copper. The block itself was made of Monel with a number of cooling grooves cut in its surface. A sheet of beryllium copper was attached to this surface to cover the grooves.

Although the beryllium-copper could be attached by brazing, problems were encountered in heat-treating the sheet to required strength levels. Diffusion welding solved this problem with use of copper and silver as intermediate materials in the joint. Because the bonding temperature of 650 F is the age-hardening temperature for beryllium copper, the required strength was obtained in the cover sheet at the same time it was bonded to the block.



BI-DEX* KEEPS YOUR EYE

ON PRODUCTION EFFICIENCY

BI-DEX

FACET TOOTH

BI-DEX* Tungsten Carbide rotary files by Grobet File Company of America, Inc. — a revolutionary new design that eliminates the "dead area" at the head of the burr, reduces chatter and build-up of chips.

If you want to keep your eye on efficient production also ask for a demonstration of the new **FACET TOOTH*** file, another momentous recent innovation in file construction, designed for greater cutting speed, longer life and greater efficiency.

BI-DEX* and **FACET TOOTH*** T.C. rotary files are available in a number of shapes and sizes.

GROBET-U.S.A.

Order from your distributor or write directly to

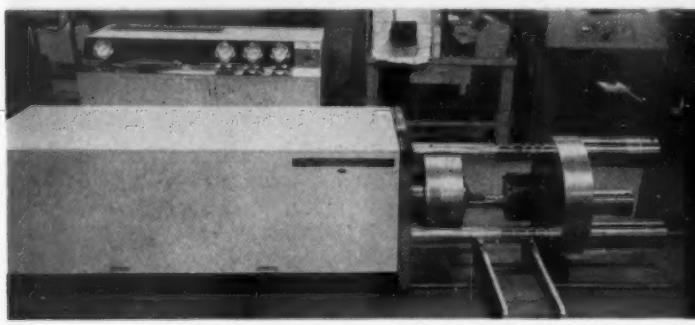
*Trade Mark

Grobet File Company of America, Inc.

Carlstadt, New Jersey — **Chicago: 311 No. Desplaines St.**

EVIDENCE

▶▶ *Here is clear evidence that high velocity extrusion of metal has dispersed stringy non-metallic inclusions. The part pictured is a hinge pin for* USAF's *B-58 Hustler. The pin on the left was machined from* AISI *4335 modified bar stock. The clearly visible inclusions made the part unfit for service. The pin at the right is made from the same material, but only after it had been extruded at very high velocities by a* DYNAPAK *machine. The inclusions have been eliminated. The part is completely satisfactory. There is no need to change to a more costly metal, or to resort to special mill heats.*



Pneumatically energized DYNAPAK, a product of General Dynamics Corporation, is industry's first practical tool for high-energy-rate metalworking. Many industries are now adapting DYNAPAK to the solution of forging, forming, and extrusion problems. The experience of Convair Fort Worth with these hinge pins gives evidence of another of DYNAPAK's advantages. The hydrodynamic behavior of metal when it is worked at DYNAPAK velocities, results in homogeniety and refinement of structure, and in dispersal of inclusions.

for complete information, write, wire, or phone:

DYNAPAK

CONVAIR / A DIVISION OF GENERAL DYNAMICS CORPORATION

1243 Transit Avenue, Pomona, California • Phone: NAtional 3-1561

DEPENDABLE . . . predictable response to heat treatment every time

Send for Bulletin 102— "Helpful Heat-Treating Hints."

The full uniformity within each bar of Desegatized FM die steel and the consistent uniformity from lot to lot simplifies the heat treatment of your die components. Predictable hardnesses are readily attainable . . . distortion and size change are minimized . . . danger of cracking is lessened!

In free machining FM die steels, full uniformity is achieved through Latrobe's unique Desegatized process of manufacture. This process guarantees an even distribution of carbide particles, free machining alloy sulphides and other alloying elements . . . factors leading to improved machinability, greater toughness and improved wear resistance in addition to the optimum heat-treating characteristics.

Latrobe's 12% chromium FM die steels are available through district steel service centers near you. Grades include: Olympic FM (Type D-2) for long-run applications; GSN FM (Type D-3) non-deforming die steel; Cobalt Chrome FM (Type D-5) for extra resistance to galling and pickup.

Call your Latrobe representative today!

Manufactured by skilled American labor

LATROBE
Metalmasters

LATROBE STEEL COMPANY
LATROBE, PENNSYLVANIA

BRANCH OFFICES and STEEL SERVICE CENTERS: BOSTON • BUFFALO • CHICAGO CLEVELAND • DAYTON • DETROIT • HARTFORD • LOS ANGELES • MIAMI • MILWAUKEE NEW YORK • PHILADELPHIA • PITTSBURGH • SAN LEANDRO • TOLEDO

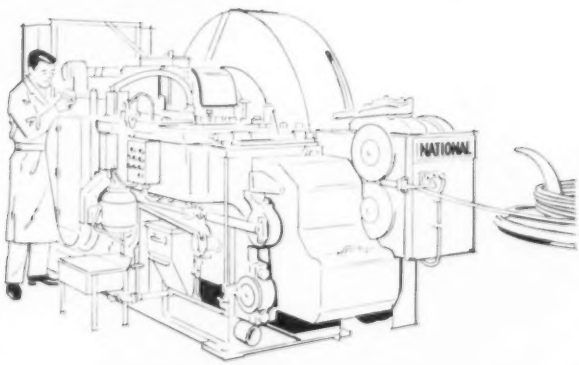
MADE FROM WIRE!

BOLTMAKERS make these interesting parts, and countless others, every day from wire.

Operations include cutting off, extruding, heading, trimming, pointing and thread-rolling.

It's just possible *your* metal parts can be made faster, stronger and at lower cost in Boltmakers (or in other types of Nationals).

May we help you investigate?



NATIONAL 1/2-INCH BOLTMAKER
4,200 PARTS PER HOUR!

Founded 1874—DESIGNERS and BUILDERS of MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS CO-PIONEERS WITH INDUSTRY OF ADVANCED METALWORKING PRODUCTION METHODS

NATIONAL MACHINERY CO.

TIFFIN, OHIO, U. S. A.

HARTFORD DETROIT CHICAGO

Now! see the NEW!
K. O. LEE GRINDERS
. . . the World's Most Versatile Grinding Machines!

The Model BA960 Universal Grinder is a result of over 30 years of experience in the manufacture of precision grinding machines, attachments and fine tools.

This machine is the biggest value in the industrial market. A truly universal machine, spindle speeds from 3450 to 20,700 RPM with standard equipment included, capable of handling all types of O.D., I.D. grinding operations demanded by the average shop.

K. O. Lee grinders have proven themselves year after year in the metal working industry. They have outsold all other grinding machines in their field.

We invite you to visit our Distributors. Compare this machine for quality, engineering, workmanship, sturdy construction and modern appearance against any machine on the market. See for yourself how much more you get for how much less you pay.

We believe that you will be pleasantly surprised.

Model BA960 Universal Grinder
SHOWN WITH B943 MOTOR-DRIVEN WORK HEAD AVAILABLE AT EXTRA COST

For Complete Information Write for Grinder Catalog TG-1 Which Lists Other Models and Fixtures

K. O. Lee Co.
ABERDEEN, SOUTH DAKOTA

Use Reader Service Card, CIRCLE 134

Rx FOR INTERNAL INSPECTION

● **0.10" AND UP** . . . That's the point of entry requirement . . . to provide your inspectors the chance to use the outstanding National Fontar Borescope and thus give them the brightest, distortion-free, close-up view of the defect in "inaccessible" interior surfaces of the cast, drawn, welded or molded product . . . from inches deep to many feet.

Find out how its use can be a time and cost saver while it up-grades your Quality Control. Just send for our "Borescope Catalog."

ENGELHARD HANOVIA, INCORPORATED
NATIONAL ELECTRIC INSTRUMENT DIVISION
92-21 Corona Avenue - Elmhurst 73, New Y

Use Reader Service Card, CIRCLE 135

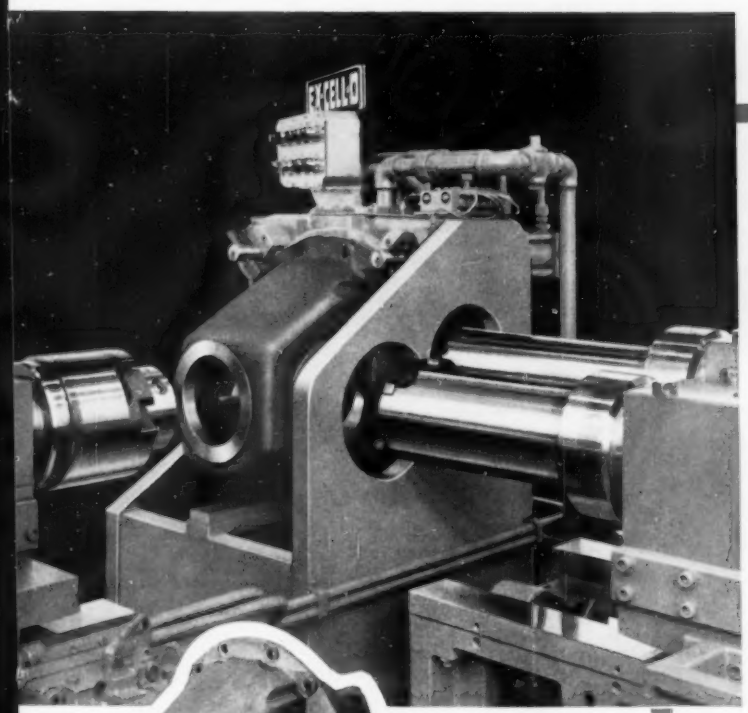
CARR-LANE JIG and FIXTURE Components . . . make the biggest HITS

. . . and why not . . . they're precision made to exacting tolerances . . . they're heat treated and rust proofed . . . they sell for a fraction of the cost of producing them in your own shop. See Our Catalog for the thousands of items in STOCK!!!

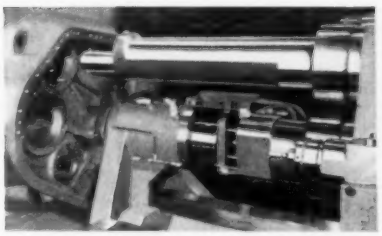
MANUFACTURING CO.
4200 Krause Court
St. Louis 19, Missouri

Use Reader Service Card, CIRCLE 136

Ex-Cell-O Custom Machines Specialize in Difficult Jobs!

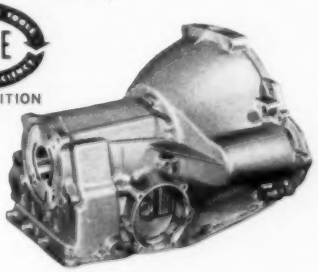


HEAVY-DUTY BORING—Custom Boring Machine uses three heavy-duty Ex-Cell-O Precision Spindles to simultaneously finish-bore four holes and bore-and-face a fifth hole in this 75-pound cast-iron housing in a 4½ minute cycle. Diameters are about 6"; tolerances are held within .001".



MULTI-DIAMETER BORING—In a single cycle, the long boring bar on this Custom Machine line-bores two holes while shorter bar below it bores a third diameter, and small spindle in foreground bores a dowel hole in this huge clutch and gear housing.

SEE EX-CELL-O'S BOOTH 946,
MMT PE
NMTBA EXPOSITION



HIGH PRODUCTION—Aluminum transmission case shown above is turned 90°, rolled over 180° as it passes through a 24-station Custom Machine. Automatic operations include precision boring, facing, chamfering, radial milling, tapping, trepanning, air gaging and flushing. Output is 124 parts per hour.

Whether you have a simple job that must be done faster and more accurately, or complex work that requires multiple machining operations, an Ex-Cell-O Custom Machine may be just the answer you've been looking for . . . the economical solution to a difficult production problem.

See your Ex-Cell-O Representative, or contact Ex-Cell-O's Machinery Division in Detroit for details on the limitless applications of Ex-Cell-O Custom Machines.

EX-CELL-O FOR PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • CONTOUR PROJECTORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • RAILROAD PINS AND BUSHINGS • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

60-31

Use Reader Service Card, CIRCLE 137

Tough tapping jobs get a "lift"...

For Specific Materials

GREENFIELD Fast Spiral Fluted Taps provide trouble-free tapping of blind holes in ductile and stringy materials. Where straight flutes become clogged with long stringy chips, spiral flutes lift and carry the chips out before they have a chance to ball up and wedge in the flutes. Spiral flutes reduce friction and eliminate a major cause of tap breakage.

For Specific Jobs

Fast Spiral Fluted Taps are especially useful in cutting holes which are interrupted by slots, keyways or other gaps. The tap remains steady at all times because all of the tap lands are in contact with the sides of the hole even when a portion of a land is spanning the open space.

... with Greenfield Fast Spiral Fluted Taps

WANT TO LEARN MORE ABOUT GREENFIELD FAST SPIRAL FLUTED TAPS? CONTACT A GREENFIELD FIELD ENGINEER THROUGH YOUR LOCAL GREENFIELD DISTRIBUTOR.

GREENFIELD TAP & DIE Greenfield, Massachusetts

SUPERIOR EXCLUSIVE FEATURES

SAFETY FLANGES

LOCK-JAW LIFTING DEVICE

E-Z LIFT SLING CHAIN

PRECISION CENTER MARKS

SUPERFINISH GUIDE PINS

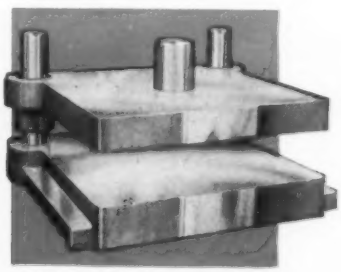
REMOVABLE CAP GUIDE PINS

THE *Exclusive* SET

Sue Perior and Spouse are first-nighters. But it seems Spouse has a problem.

If you have die set problems . . . if you want more safety, finer precision, greater ease of handling, lower production costs . . . investigate the exclusive features of Superior die sets.

Write for the new features catalog today!



SUPERIOR STEEL PRODUCTS CORP.
2754 South 19th Street • Milwaukee, Wisconsin
Cheshire, Connecticut

Use Reader Service Card, CIRCLE 142

BATH Tap'n Gage TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 16

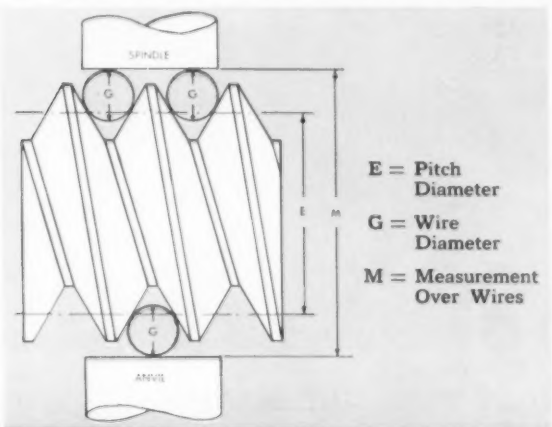
Subject: Three Wire Method of Measuring the Pitch Diameter of Straight 60° Screw Threads:

The three wire method of measuring the pitch diameter of straight 60° screw threads is one of the most accurate and satisfactory for the measurement of screws, thread plug gages, externally threaded products and taps having an even number of flutes.

This method of measuring the pitch diameter requires the use of some form of micrometer and three hardened steel cylinders or wires of correct size placed in the thread groove; two on one side of the screw and one on the opposite side as shown in the illustration below.

The "best size" wire for a given pitch is one that touches the exact mid-slope of a perfect thread. However, any size wire may be used that will rest on the sides of the thread and also projects above the major diameter of the thread.

The accuracy of the pitch diameter readings depend on the roundness of the wire diameters, the contact load and the accuracy of the measuring instruments. In most cases, if the "best size" wires are used, the slight effect of a lead angle of 5° or less need not be considered in the computation of the pitch diameter unless a very high degree of accuracy is necessary. For further reference, see the U.S. Dept. of Commerce, National Bureau of Standards Handbook H28 (1957) Part 1.



MEASUREMENT OVER WIRES

When the "best size" wires are available:

To pitch diameter, add constant for "best size" wire

Example: Pitch diameter of 3/8"-16 screw = .334400"
Constant for "best size" wire = .054126"
Measurement over wires = .388526"

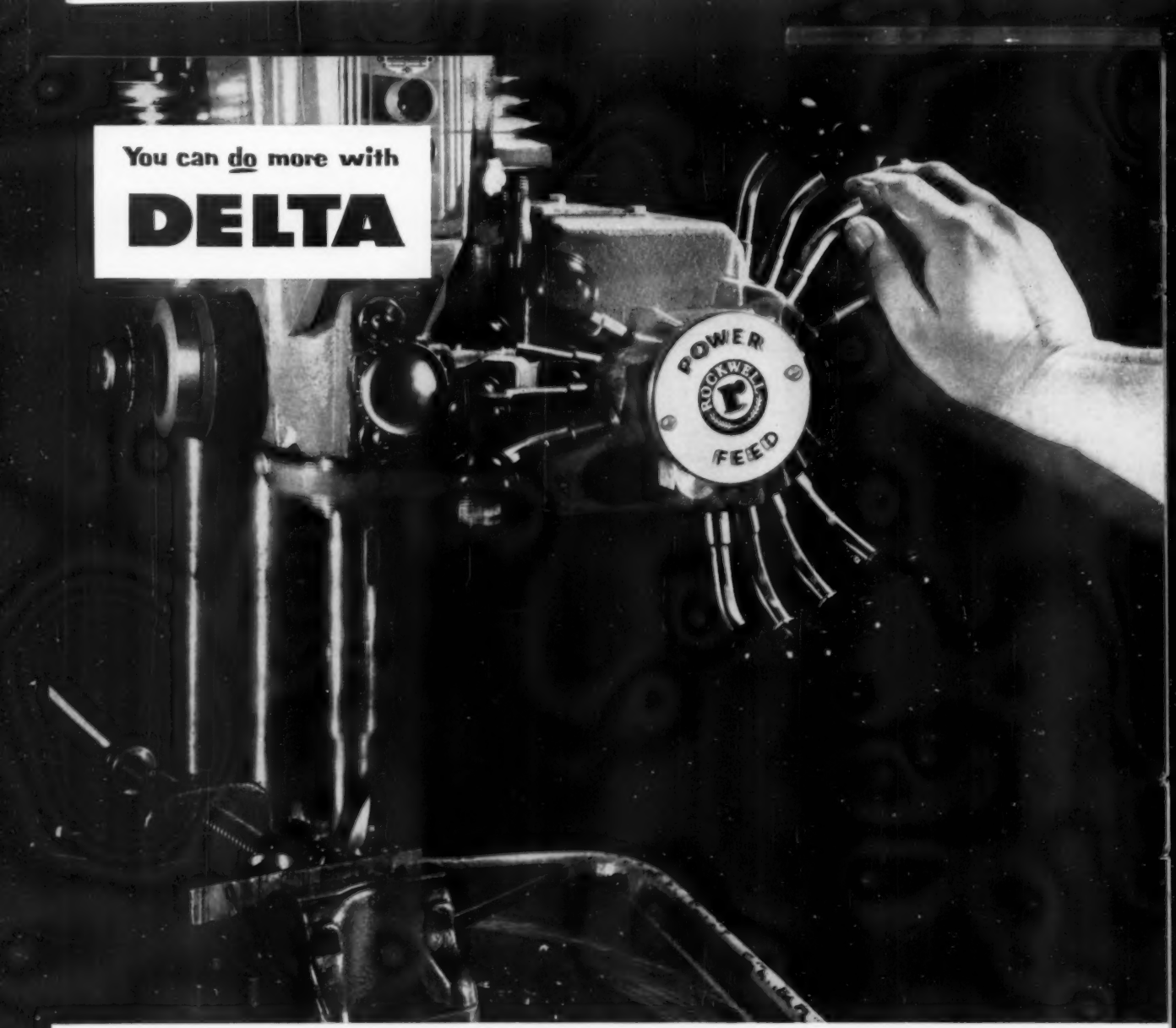
When the "best size" wires are not available:

Subtract from pitch diameter, the constant for "best size" wire and to the result add 3 times the diameter of the available wire.

Example: Pitch diameter of 3/8"-16 screw = .334400"
Minus the constant for "best size" wire = .054126"
.280274"
Plus 3 times .040" (available wire) = .120000"
Measurement over wires = .400274"

Threads Per Inch	Pitch	Diameter of "Best Size" Wires	Constant* for "Best Size" Wires
80	.012500	.0072168	.010825
72	.013888	.0080182	.012027
64	.015625	.0090210	.013531
56	.017857	.0103097	.015464
50	.020000	.0115470	.017320
48	.020833	.0120279	.018041
44	.022727	.0131214	.019682
40	.025000	.0144337	.021650
36	.027777	.0160370	.024055
32	.031250	.0180421	.027063
30	.033333	.0192448	.028867
28	.035714	.0206194	.030929
27	.037037	.0213833	.032074
26	.038462	.0222057	.033308
24	.041666	.0240558	.036083
22	.045454	.0262428	.039364
20	.050000	.0288675	.043301
18	.055555	.0320746	.048112
16	.062500	.0360843	.054126
14	.071428	.0412389	.061858
13	.076923	.0444114	.066617
12	.083333	.0481123	.072168
11½	.086956	.0502040	.075306
11	.090909	.0524863	.078729
10	.100000	.0577350	.086602
9	.111111	.0641499	.096224
8	.125000	.0721687	.108253
7½	.133333	.0769800	.115467
7	.142857	.0824784	.123717
6	.166666	.0962246	.144336
5½	.181818	.1049726	.157458
5	.200000	.1154700	.173205
4½	.222222	.1282998	.192449
4	.250000	.1443375	.216506

*Also single height V-thread

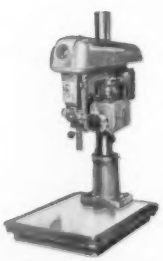


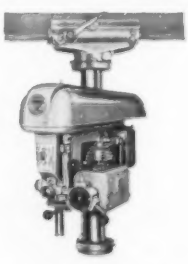
NEVER BEFORE—UP FRONT CONTROL WITH ONE HAND OPERATION

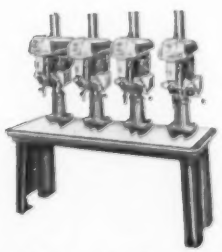
Unique pilot wheel control is mechanically integrated with the clutch control, allows operator to engage power feed with a simple wrist movement of one hand. Without any adjustments, operator can use rapid manual approach then power feed, skip drilling technique, straight power feed or straight manual feed. There are four feed ratios—.004, .006, .009 and .012 ipr—with each of five available spindle speeds.

NEVER BEFORE—SUCH A COMPLETE CHOICE OF MODELS


Floor model


Bench model

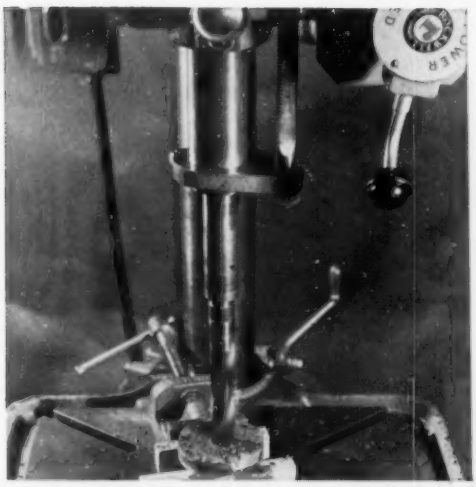

Overhead model


Multiple spindle model

ROCKWELL ANNOUNCES . . .

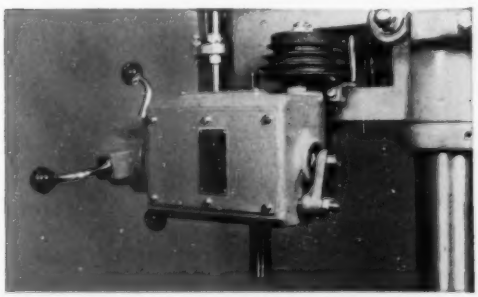
NEW POWER FEED

on famous DELTA 20" drill presses



NEVER BEFORE—"JOB TAILORED" DRILL POINT PRESSURE

A lathe-type cone clutch enables operator to adjust drill point pressure from 0 to maximum capacity of machine to permit power feeding on a production basis through a wide range of hole diameters. It furnishes power and thrust for drilling holes up to 1", yet delicately handles drills down to 1/16" diameter. Torque sensitive adjustability feature stops feed when overloaded—avoids drill breakage.



NEVER BEFORE—REMOTE CONTROL AND AUTOMATION

Actuating plunger, an extension of the clutch shaft, permits remote control which frees operator from manual effort. The power feed can be electrically, hydraulically, pneumatically, or mechanically interlocked with other machines or synchronized with devices such as rotary tables, clamps and work feeds for semi or full automatic operations.

Now Delta brings you advantages NEVER BEFORE AVAILABLE on a standard drill press—with the most advanced development in mechanical power feeds. Every model in the new Delta 20" drill press line offers power feed that gives you: *a front mounted pilot wheel for effortless one hand operation; infinitely adjustable drill point pressure; built-in feature that permits remote control or interlocking with automation devices.*

With the flexibility of feeds afforded by "flick of the wrist" control, operator's work is limited to loading, unloading, and actuating the tool. You get the adaptability of a power tool with the ruggedness, precision and capacity of a machine tool. Capable of handling production metalworking jobs done by machines costing much more, these new Delta power feed drill presses provide a simple, low cost method of increasing productivity and improving drilling quality.

Thoroughly tested through a rugged trial of 750,000 drilling cycles, Delta's new power feed line offers many other outstanding features and NEVER BEFORE AVAILABLE benefits that you cannot appreciate unless you see them demonstrated IN ACTION. Let your Delta Industrial Distributor show you how the 20" power feed drill press can help you cut costs (he's listed under "TOOLS" or "MACHINERY" in the Yellow Pages). Meanwhile, for FREE brochure giving details and specifications *plus* information on how to add New Power Feed to your present Delta 20" drill press, write: Rockwell Manufacturing Company, Delta Power Tool Division, 620F N. Lexington Avenue, Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Box 420, Guelph, Ontario.

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

Use Reader Service Card, CIRCLE 144

an ASTME Show highlight

CP demonstrates latest in "One-Shot" Torque Control Screwdrivers and Nutrunners

The CP Booth at the ASTME Show in Detroit really packed them in. Production men responsible for assembly, quality control and standards learned first-hand facts about "one-shot" Torque Control tools. They watched new hand-held tools and multi-spindle units prove their consistent accuracy... saw a new Torque Analyzer prove its ability to test and calibrate Torque Control power tools. They proved for themselves, that CP Screwdrivers and Nutrunners can hold the specific torque settings so essential on today's fast-moving production lines.

The CP exhibit featured the most extensive line of standard "one-shot" straight and angle Screwdrivers and Nutrunners, Multiple Motors and Impact Wrenches ever offered to the assembly industry.

If you missed the show... don't miss the facts. To get the full story on CP "One-Shot" drivers for hand-held or multi-spindle job requirements – use the handy coupon below.

NEW CP-200 Torque Analyzer tests and calibrates torque control power tools.

NEW CP-3017 Dial Tork Nutrunner, the only instantly adjustable power tool that inspects as it drives.

NEW Micro-Tork Screwdrivers for large or small fasteners.

NEW CP-3090-ATN-300 "jolt-free" Angle Nutrunner.

GET 12 PAGES OF STRAIGHT FACTS ON "ONE-SHOT" TORQUE CONTROL TOOLS. USE THIS COUPON TO MAKE SURE OF YOUR FREE COPY.

Chicago Pneumatic Tool Co., Dept. T-60
8 East 44th Street, New York 17, N. Y.

Please send a copy of SP-3266, your 12 page color booklet on "One-Shot" Torque Control Screwdrivers, Nutrunners, Angle Nutrunners, Multi-Runner Motors and Torque Analyzers.

Name_____

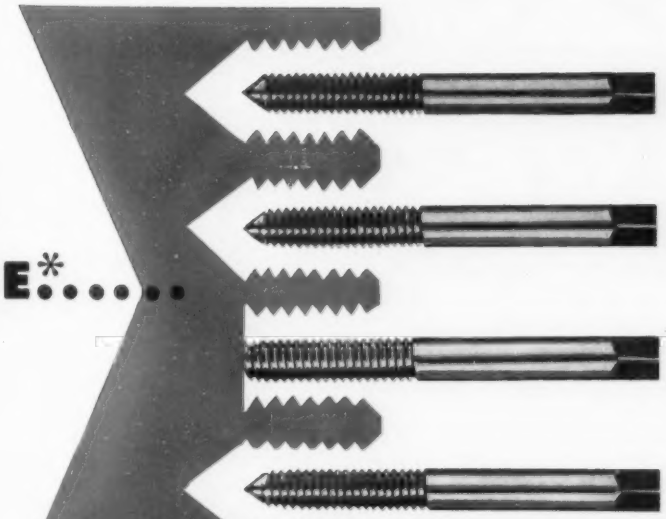
Company_____

Address_____

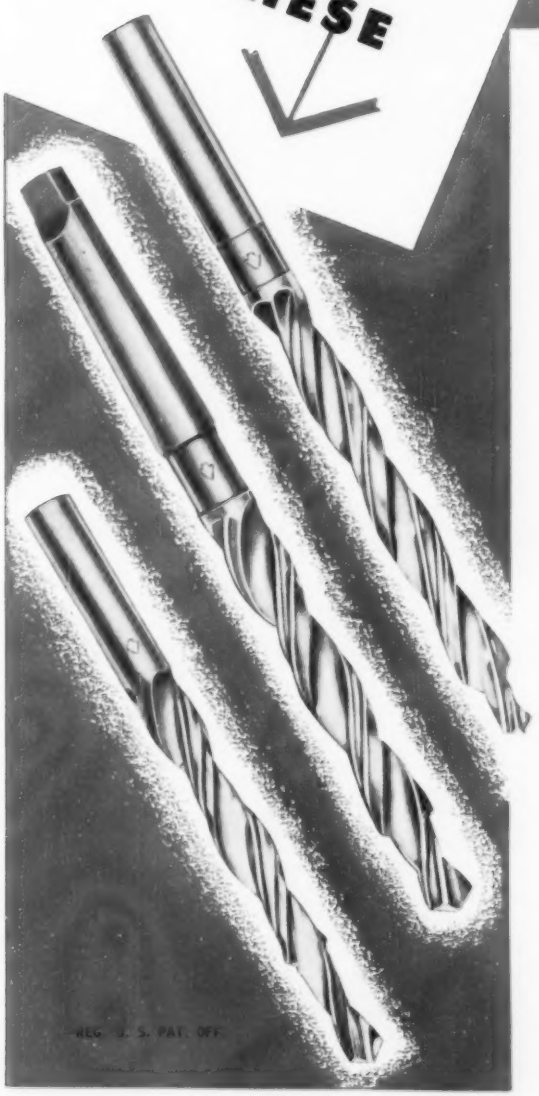
City_____ Zone_____ State_____

YOU CAN SAVE MORE OF THESE*.....

BY USING THESE



* Fluteless (non-cutting) taps for cold-forming threads in soft metal such as aluminum, zinc, copper, brass, leaded steels, etc.

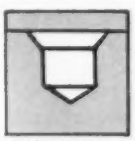


MOHAWK STANDARD SUBLAND DRILLS

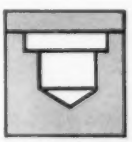
If you are now using the popular new fluteless (non-cutting) tapping principle for softer metals, you can further improve and simplify your tapping operations through the use of Mohawk Standard Drill-Chamfer sublands. Mohawk drill-chamfer "standards" will simultaneously drill and chamfer clean, concentric holes that will speed your basic tapping operation, eliminate breakage and scrap, reduce your drilling tool inventories, eliminate jig and fixture movement.

If you are interested in drilling tools that really pay for themselves, examine your drilling and tapping costs, then see for yourself how many places a Mohawk "standard" could easily improve the job and reduce your costs.

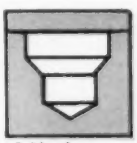
AVAILABLE FROM STOCK—Mohawk "standards" are immediately available in all practical sizes, types and combinations in choice of 3 step lengths and 3 shank styles.



Subland Drill-Chamfer for Regular Taps Fluteless Taps Pipe Taps Heli-Coil* Taps



Subland Drill Counterbore for Socket Head Cap Screws



Subland Drill-Drill for Tap Drill and Body Clearance

Mohawk TOOLS, Inc.
Montpelier, Ohio

WRITE TODAY . . . for your own copy of the big, new catalog of Mohawk Standard Subland Drills.

you'll do a better filing job with a

SIMONDS RED TANG

- ★ AMERICAN Pattern
- ★ SWISS Pattern
- ★ VIXEN Milled Curved-Tooth
- ★ ROTARY Files and Burrs

(Complete Line includes All Sizes, Shapes and Types)

SIMONDS NEW **MULTI-KUT FILE** — with criss-cross design — an extremely useful all-around file for maximum stock removal, smooth finish and long life on any fileable material. Multi-Kut files are available in Flat, Half-Round, and Square in 8", 10", 12" and 14" lengths.

For hogging off metal or smooth finish filing . . . for intricate die work or production de-burring . . . for sharpening saws or restoring knife and tool edges to former cut-ability, Simonds RED TANG Files make your work easier . . . make your file dollars go farther. They cut fast and sure . . . last longer, too . . . because they're FIRST QUALITY only. They're sharper to start with . . . resist wear . . . keep right on cutting long after other files are dull and useless. These are facts we can prove — so can you by simply specifying SIMONDS RED TANG on your next file order. All sizes, shapes and types in all patterns are available from stock in the complete Simonds line.

Your nearby SIMONDS DISTRIBUTOR is your most dependable cutting tool supply source. His stocks and services are designed with your convenience and economy in mind. Call him FIRST for all your industrial supply needs!

SIMONDS SAW AND STEEL CO.

FITCHBURG, MASSACHUSETTS

Factory Branches in Boston, Chicago, Shreveport, La., San Francisco and Portland, Oregon • Canadian Factory in Montreal, Que. • Simonds Divisions: Simonds Steel Mill, Lockport, New York; Heller Tool Co., Newcomerstown, Ohio; Simonds Abrasive Co., Philadelphia, Pa. and Arvida, Que., Canada

New MODEL 50 equips your lathes to do a lot more for a lot less!

$70.00 for the chuck

$65.00 for the collets

THE WORLD'S MOST MODERN COLLET CHUCK

Designed expressly for ATLAS, CLAUSING, DELTA, LOGAN, SHELDON, and SOUTH BEND LATHES

These and others of similar power and capacity now give top performance when equipped with the new Jacobs Model 50. Improve performance of your lathes. Increase spindle capacity as much as 42%. Get greater accuracy and stronger grip. It's easy and inexpensive with new Model 50 and its companion Rubber-Flex collets.

CONSIDER THESE FEATURES . . .

- **Gripping Power**
  Model 50 is made for heavy duty turning. It has tremendous gripping power.
- **Accuracy**
  Model 50 is factory tested—maximum runout .001" T.I.R. at the nose when properly mounted.
- **Thin Walled and Fragile Work**
  Always parallel Model 50 Rubber-Flex collet jaws permit chucking of tubing and fragile materials without crimping or scoring.
- **Range**
  The 10 Rubber-Flex collets in the 500 Series, developed especially for use with Model 50, cover a greater bar stock range than 63 old-fashioned steel collets. You can chuck any bar between 3/32" and 1-1/16" with this set of 10 collets.
- **Capacity**
  Model 50 eliminates capacity-wasting draw bar. You can increase spindle capacity up to 42%.
- **Adapters**
  Model 50 adapters are fully machined for immediate mounting. Available in all popular threads and American Standard L00 taper.
- **Price**
  Model 50 prices are revolutionary!
  $70.00 for the chuck.
  $65.00 for the complete set of 10 collets.

MODERNIZE YOUR LATHES WITH JACOBS MODEL 50 AND RUBBER-FLEX COLLETS. YOU CAN'T AFFORD NOT TO!

See your Jacobs industrial supply distributor. Give him the opportunity to prove these fantastic facts with a convincing demonstration at your desk! Call him today.

Jacobs CHUCKS

The Jacobs Manufacturing Co., West Hartford 10, Conn.

THE BELLOWS AIR MOTOR®

THE ONLY AIR CYLINDER WITH A CHOICE OF BUILT-IN VALVES

In designing for air operation, the engineer can choose the method of valving he prefers—and still have all the advantages of integral valve and cylinder construction.

Six different built-in valve arrangements give the engineer every latitude in pneumatic design.

If he prefers to use 8-12 volt electrical control with its simplified wiring, Bellows has it. If he prefers to use 115 volt control and JIC standards, Bellows has it. If he requires low or high voltage explosion-proof control, Bellows has it. Should his design require full pneumatic control, Bellows has it. Or should he wish to control his pneumatic circuits manually or through mechanical linkage or cams, Bellows has it.

Unlike conventional air cylinders which require separate remote directional and speed control valves and dual piping, the Bellows Air Motor is a complete power unit with directional valve and dual speed control valves built-in as an integral part of the unit. Only one air connection, which can be made with flexible hose, is required.

Integral valve and cylinder construction means quick response, more positive response, more precise control and more economical operation.

The Bellows Air Motor is made in five bore sizes: 1¼", 1¾", 2½", 3⅝", and 4½", and in any stroke length.

***WRITE FOR THIS BULLETIN* TODAY!**

Four-color, 20-page bulletin describes the complete line of Bellows Air Motors. Free on request. Address Dept. TE-660, The Bellows Co., Akron 9, Ohio.

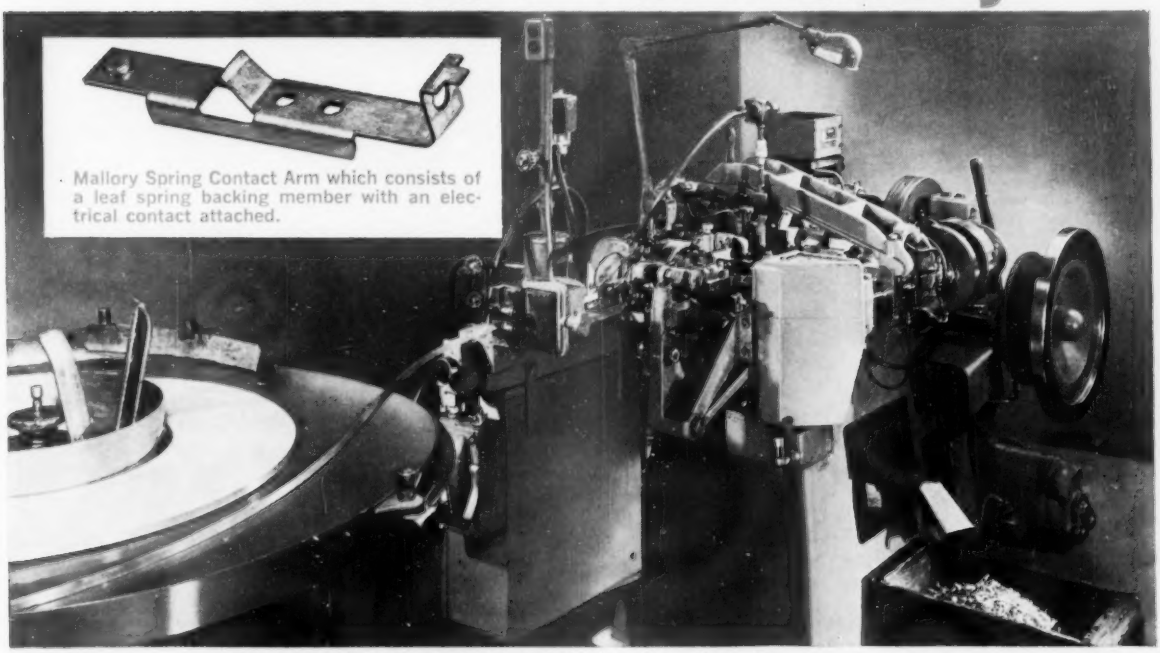
627C-3

Bellows-Valvair

The Bellows Co. • Valvair Corp. Akron 9, Ohio

DIVISIONS OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

U. S. MULTI-SLIDE® cuts contact assembly costs 20% at P. R. Mallory



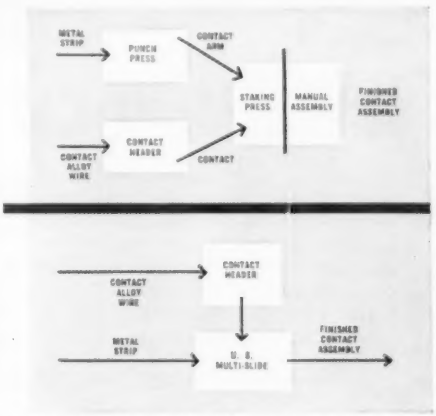
Mallory Spring Contact Arm which consists of a leaf spring backing member with an electrical contact attached.

U. S. Multi-Slide Model No. 28 with AR-10-48 U. S. Automatic Stock Reel in action at P. R. Mallory & Co., Inc., manufacturers of Electrical and Metallurgical Components, in Indianapolis.

By the use of a U. S. Multi-Slide Model No. 28, P. R. Mallory and Co., Inc. — specialists in complete contact service — entirely eliminated one costly operation in the fabrication and assembly of Spring Contact Arms.

Today, these Contact Arms are formed **and** assembled on a U. S. Multi-Slide. Coil stock for the Contact Arms is fed from a Model AR-10-48 U. S. Automatic Stock Reel. This Multi-Slide pierces, trims, forms and cuts off the spring arms and attaches the prefabricated, hopper fed contacts in one continuous, automatic operation.

In volume production, complete contact assemblies now cost **$3.19 per thousand less** — a savings of 20%. And, according to Mallory, this automatic U. S. Multi-Slide production also improved product quality and reduced waste.



This shows how a U. S. Multi-Slide eliminated a separate staking press operation. This operation (now eliminated) required manual loading which was slow and costly.

Find out for yourself how U. S. Multi-Slides can cut costs, reduce waste and improve the quality of your products —

Write for U. S. Tool Company Bulletin No. 15T.

MMT-PE MODERN MACHINE TOOLS PRODUCTION EFFICIENCY

MULTI-SLIDE®

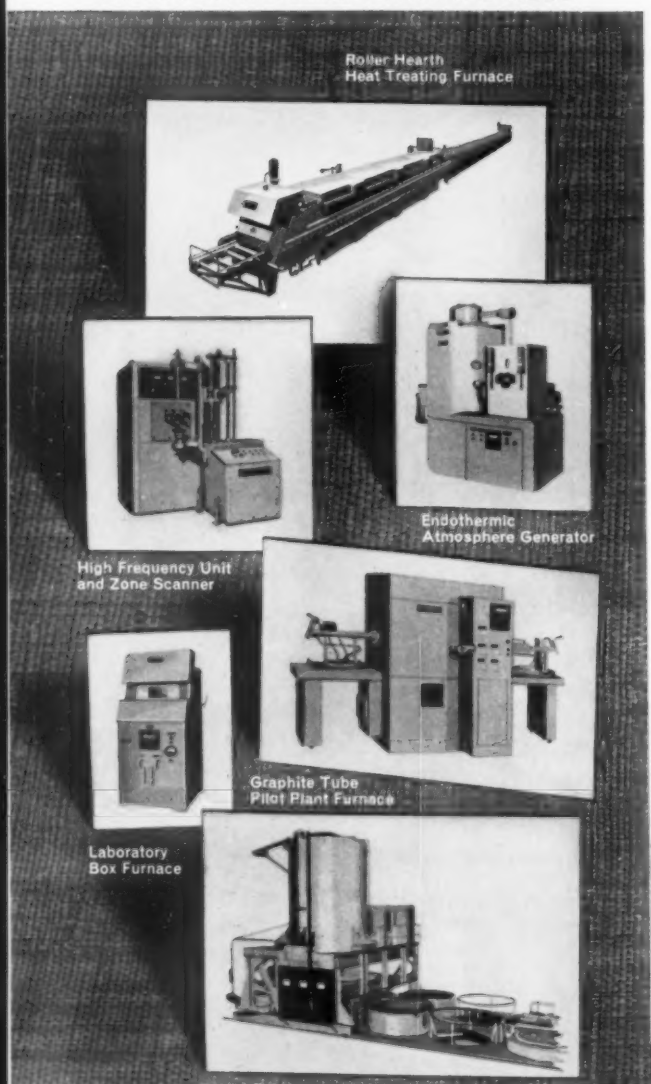
U.S. TOOL COMPANY, INC.

AMPERE (East Orange) NEW JERSEY

U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

THE BIGGEST INDUSTRIAL HEATING JOB CAN BE ENTRUSTED TO LINDBERG'S *PLUS* DIMENSION IN SERVICE

THERE'S LINDBERG EQUIPMENT FOR EVERY INDUSTRIAL HEATING NEED



These are representative units from complete Lindberg lines in all types of industrial heating equipment.

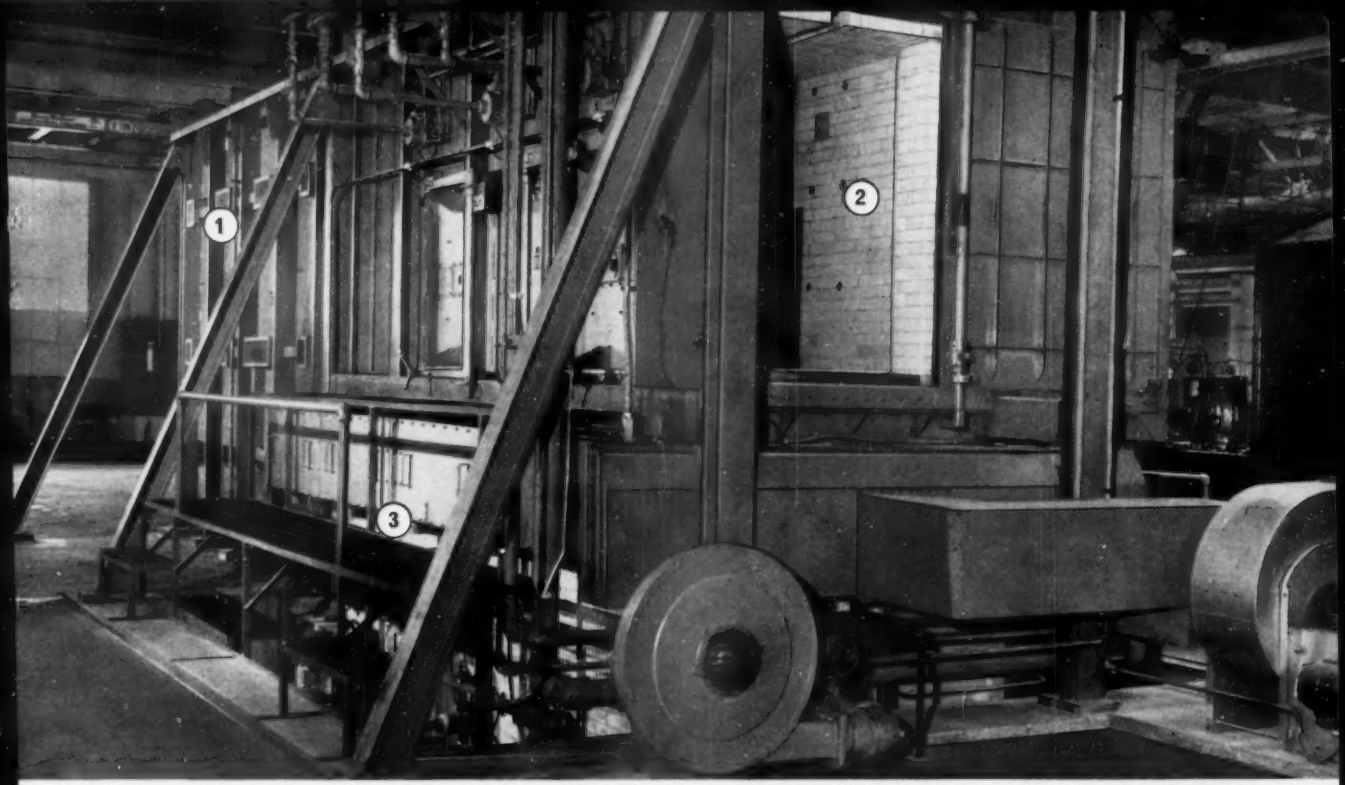
The plus dimension in service Lindberg offers today can provide a complete answer to any problem requiring the application of heat to industry. Give us your specific requirements for a part or a product and we will develop the right processes, design, engineer and install equipment and facilities.

This service covers broad requirements—from plant layout and construction to automated production lines, or just specially engineered industrial heating equipment efficiently integrated into your production processes. For example, Lindberg Industrial Division has recently completed or is in the process of installing such varied projects as:

- Complete plant layout and equipment for brazing honeycomb
- Complete installation for heat treating raw aluminum products including furnaces, foundations, roof and lighting
- A fully automated production line for heat treating plow shares
- Two large ceramic kilns embodying a new concept of making high-refractory bricks
- Complete, automated production line for enameling and drying hot water heaters

You obtain many advantages from Lindberg. You get the combined skills of what we believe to be the country's finest group of engineers and technicians in the industrial heating field. Our experience covers the whole range of "heat for industry" methods so you can rely on us to recommend the most suitable equipment and processes. You will get your installation from one responsible source, guaranteed to achieve the results you need and ready to go to work at the turn of a switch.

Lindberg Industrial Division, Lindberg Engineering Company, 2321 West Hubbard Street, Chicago 12, Illinois. Los Angeles Plant: 11937 South Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg, Ltd., Toronto.

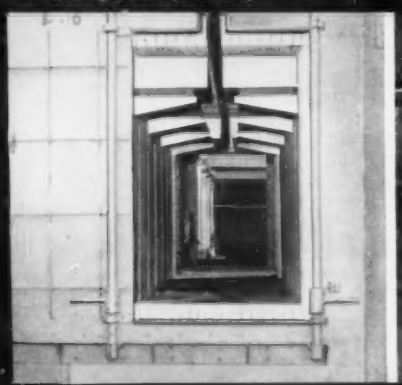


This Lindberg installation at Stewart-Warner Corporation, Indianapolis, combines (1) Pre-heat Furnace (2) Holding Furnace and (3) Lindberg-Upton Salt Bath Furnace.

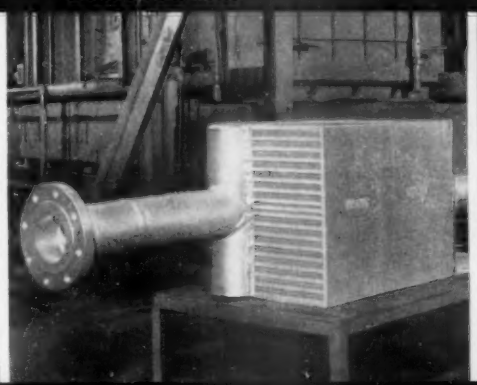
LINDBERG SUPPLIES COMPLETE INSTALLATION FOR DIP BRAZING ALUMINUM HEAT EXCHANGER CORES

Brazing large aluminum plate-and-fin heat exchanger cores requires close tolerances and precise controls. Stewart-Warner Corporation, Indianapolis, chose Lindberg Industrial Division to design and install the right equipment to perform this exacting process efficiently and economically. The main unit, shown above, combines Lindberg Preheat and Holding Furnaces and Lindberg-Upton Salt Bath Furnace. Cores are brought to the desired temperature, moved to holding furnace section, then lowered into the salt bath. Automatic controls maintain required salt bath temperature to extremely close limits. Brazed cores are raised to holding furnace for drainage, moved through a cooling chamber, steam cleaning booth and five dip rinse tanks for thorough cleaning. This installation is another example of the complete design, engineering and installation service Lindberg Industrial Division offers industry. Whenever you have a product or process requiring the application of heat, consult your local Lindberg Field Engineer, (see your phone book) or write us direct. Lindberg Engineering Company, 2447 West Hubbard St., Chicago 12, Illinois. Los Angeles plant: 11937 South Regentview Ave., Downey, California. In Canada: Birlefco-Lindberg, Ltd., Toronto.

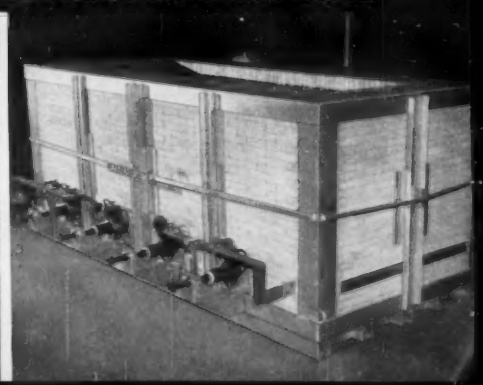
Design of unit permits convenient movement of cores through pre-heat (foreground) to holding section (at far end).



The aluminum heat exchanger cores being brazed in the unit have heat transfer surfaces of 8000 sq. ft. or more.



Lindberg-Upton Salt Bath Furnace in unit features exclusive Graphite "Continuing" Electrodes, and has a capacity of more than 12 tons molten salt.



America's finest automatic transfer machines now available to outside companies!

You know Sylvania for light bulbs, radio tubes, fine electronics equipment. (You also know how exacting specifications have to be to make such fine products on automation machinery.) Over 20 years ago Sylvania discovered there were no transfer machines available to meet our unusual standards of required accuracy. To get the exceptional machines we needed, we had to make them ourselves. We have been doing it ever since.

Now these machines are available to outside companies seeking this same extraordinary degree of accuracy.

Ideal for high-speed automatic fabricating, finishing, assembling, indexing, packaging, these machines are available in two general types:

1. Rotary indexing chassis in two sizes and in single and double turret models. Made with unusually great driving and tool capacity. Note: top of transmission spider is specially machined for rotary vacuum or pressure valve.

2. Conveyor indexing chassis, exceptional for the extreme accuracy, strength and versatility of its chain—not made commercially, but by Sylvania itself. You also get greater tool and driving capacity than in other such chassis on the market.

Also, precision indexing transmissions (5 models)

- **Heavy-duty unit** with extra-large cam well and spider diameter for wider range of stops per revolution.
- **Standard unit** features higher cam speeds, a provision to integrally mount rotary vacuum or pressure valves.
- **Universal unit** operates with its output shaft horizontal or vertical. Has wide range of applications.
- **Small universal unit.** Lower silhouette and extra-long input shaft are main features of this extremely durable, accurate transmission.
- **Conveyor unit.** Very rugged, heavy-duty unit designed for conveyors, but easily adaptable for rotary tables, other intermittent motion machines.

Send for free brochure!

SYLVANIA LIGHTING PRODUCTS
Equipment Development Plant
121 Loring Avenue, Salem, Mass.
Please send me free brochure of:
☐ ROTARY ☐ CONVEYOR ☐ TRANSMISSIONS

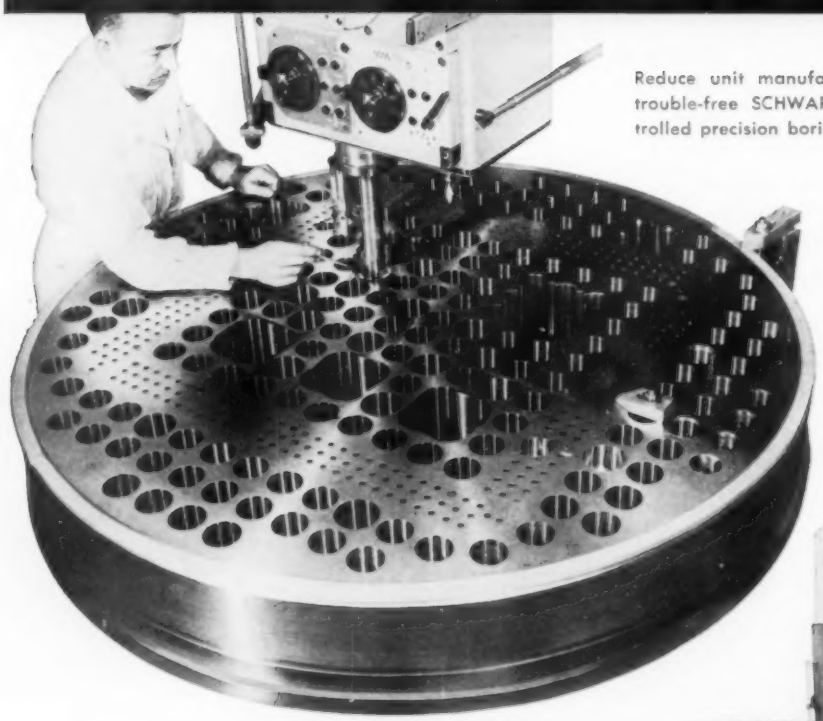
Name_____
Position_____
Company_____
Address_____
City_____ Zone_____ State_____

SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**

Cut Costs

Lead time practically NIL With **Schwartzkopff** Numerically Controlled Combination Boring—Milling Machines



Reduce unit manufacturing costs now with the new trouble-free SCHWARTZKOPFF KBF2. Numerically-Controlled precision boring and milling machine.

Checking setup for milling stainless steel automatic grid plates of 6′ diameter 10″ deep.

Boring of small high precision gear boxes is being done automatically with equal efficiency on the KBF2.

Other Features:

- **Capacity: 50″ long**
  30″ wide
  48″ high
- **Preselector for feeds and speeds**
- **Pushbutton control throughout**
- **Rapid power traverse of spindle up and down**
- **Power tool lock**
- **Hand positioning for small lots**
- **Lead time practically nil**

For Full Particulars Write or Phone:

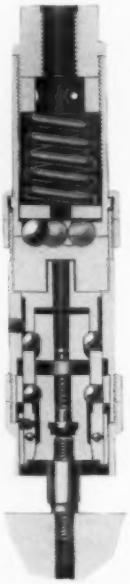
MARAC
MACHINERY CORPORATION
108 Grand St., White Plains, N.Y. • WHite Plains 6-0920

NEW

Controlled (Torque) Drive

STUD DRIVER

. . . for Stud Driving applications requiring limited torque while driving the stud



A necessity where a limited amount of torque is desired—as in driving shoulder studs.

As shown in the sectional view, this new tool has an adjustable over-running clutch so that the stud can be driven to any predetermined torque. Simple adjustment is made by removing the two Allen screws in the spring adjusting nut (directly above spring) and moving it downward for increased torque, or upward for decreased torque. It is not necessary to stop rotation at any time while driving studs. Other outstanding Titan Stud Driver features are an automatic take-up for jaw wear, and an inexpensive method of changing the cam ring.

While not designed for use with impact wrenches it is an ideal tool for use with any air or electric drill or drill press at constant speed. Available in sizes No. 101, No. 102 and No. 103.

Write for details and prices

TITAN TOOLS

World's Largest Producers Of Stud Drivers And Pullers

TITAN TOOL CO.

44 MAIN ST., FAIRVIEW (ERIE COUNTY), PA.

Use Reader Service Card, CIRCLE 175

"A.N.D." and "M.S." HYDRAULIC CONTOUR CUTTERS in stock

A.N.D. 10050 internal

Economy series; integral plain pilot

Turret lathe and drill press series; integral carbide reamer pilot

Heavy duty series; replaceable carbide reamer or plain pilot, carbide and HSS

Write for sizes and prices.

MS33656, MS33657, MS33514, and MS33515 O.D. flat form tools

Carbide tipped High speed steel

MS33514 internal

Solid carbide, carbide tipped, high speed steel models

MS16142 internal S.A.E.

Carbide tipped; plain or reamer pilot

SONNET Tool and Mfg. Co.

580 NORTH PRAIRIE AVENUE
HAWTHORNE, CALIFORNIA

Use Reader Service Card, CIRCLE 177

PRECISION SPINDLE DIVISION

the STANDARD electrical tool co.

2499 RIVER ROAD, CINCINNATI 4, OHIO

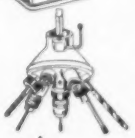
The Machine Tool Exposition
Chicago
Sept. 6-16
Booth 1450

Use Reader Service Card, CIRCLE 176

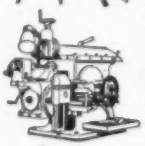
JEMCO MACHINE TOOLS

PUNCH SHAPER—SAVE FROM 50% to 80% MACHINING TIME. Machines contour surfaces, metal stamping punches with curved necks, brass electrodes, etc. Complete in one set-up to within a guaranteed accuracy of ±.00025".

Let us quote on your special punch requirements.



10 SPEED TURRET DRILL HEAD—SAVE FROM 40% to 60% MACHINING TIME. Fits any single spindle vertical drill press or miller. Drills 2 to 7 holes . . . taps 2 to 7 sizes in one set-up.



QUICK SET UP TOOL ROOM SHAPER—completely equipped—all set-ups take less than 5 minutes.

DISC FILER—Eliminates hand filing—for all metals, wood & plastic. Files any angle or radii in seconds. Easily adaptable for production line output. Fixtures easily mountable.

DRILL GRINDERS—Range .012" to 3". Floor and Bench Models.

Jersey manufacturing co.

401 E. LIVINGSTON ST., ELIZABETH 1, N. J.

Use Reader Service Card, CIRCLE 178

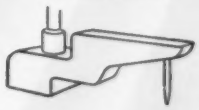
It's new . . .

It's here . . .

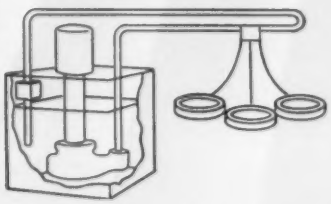
It's the NEW LAPMASTER

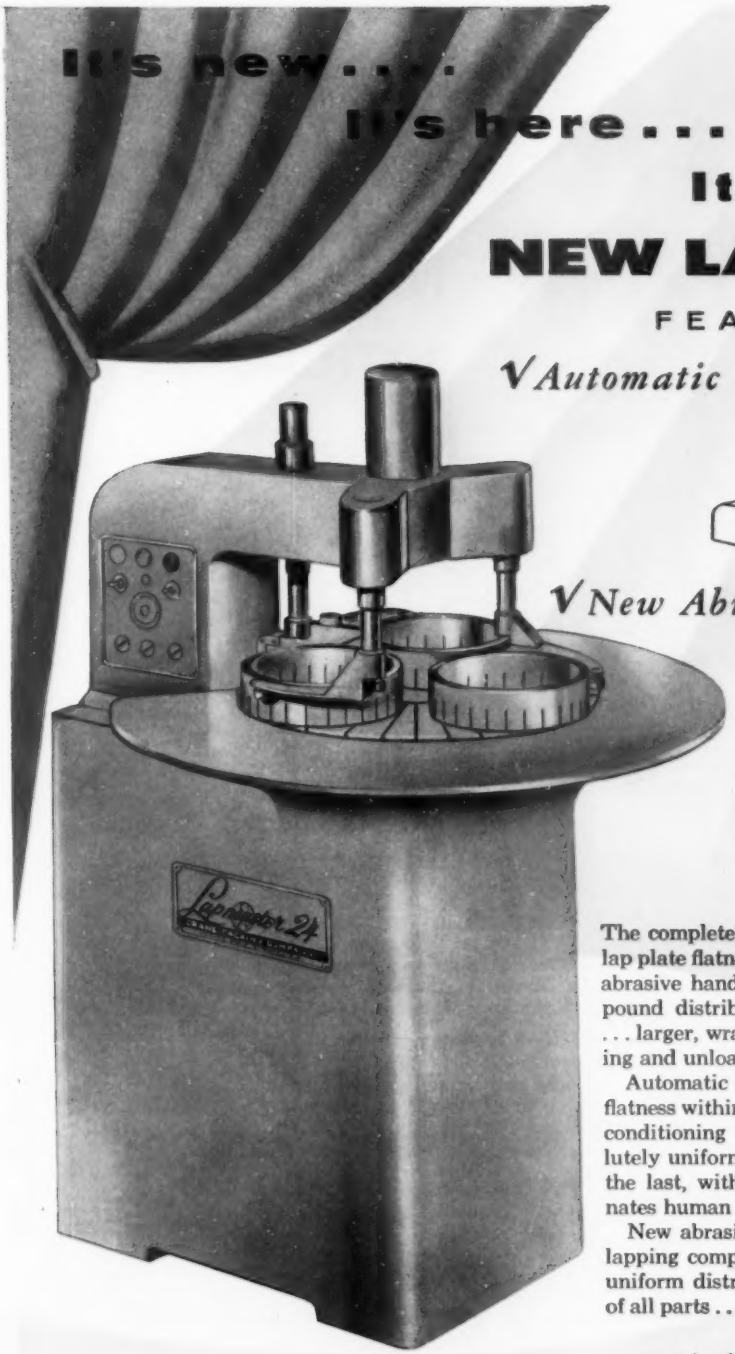
FEATURING:

√Automatic Control of Lap Plate Flatness



√New Abrasive Distribution System





The completely new Lapmaster gives you automatic lap plate flatness control . . . PLUS . . . the ultimate in abrasive handling efficiency with a brand new compound distribution system . . . new, compact design . . . larger, wrap around work table to facilitate loading and unloading.

Automatic sensing head detects errors in lap plate flatness within one light band . . . automatically shifts conditioning rings to compensate . . . assures absolutely uniform lapped surfaces from the first piece to the last, without operators' attention and . . . eliminates human error and rejects.

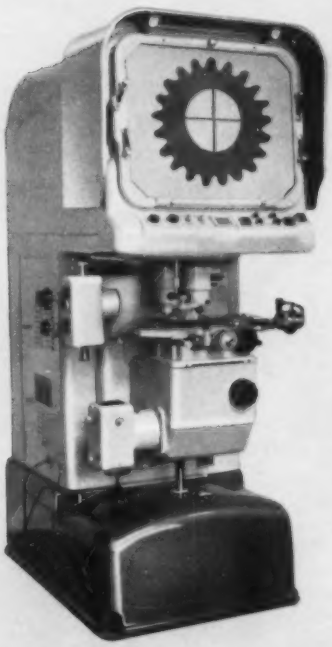
New abrasive dispensing system keeps mixture of lapping compound and vehicle consistent . . . assures uniform distribution . . . equal rate of stock removal of all parts . . . adjustable flow control . . . no clogging.

Send for the Complete Story

. . . get all the facts on this spectacular new machine . . . and ask for our new catalog covering all other Lapmaster models.

Lapmaster®
. . . THE MACHINE THAT PUT PRECISION LAPPING ON A PRODUCTION BASIS

A product of
Crane Packing Company
6469 Oakton Street, Morton Grove, Illinois
In Canada: Crane Packing Company, Ltd., Hamilton, Ont.



the New Model 5A

NIKON OPTICAL COMPARATOR

with large screen
18 x 22 inches

A large-screen optical comparator may be no great innovation. But, when a large screen has the illumination brilliance which Nikon has brought to comparators; and the sharpness and edge-to-edge resolution which Nikon comparator lenses have demonstrated; this announcement begins to assume new importance.

The new Nikon 5A is probably the most advanced optical comparator in the field today. As in the case of other Nikon comparators, the 5A has facilities for surface as well as contour measurements and inspection. And for surface inspection, Nikon does not limit you to conventional oblique lighting. Nikon half-reflecting mirrors, available for each of the comparator lenses, provide vertical, shadowless surface illumination on the optical axis. The elimination of shadow permits greater accuracy in making surface measurements. This is further aided by the brilliance achieved in surface illumination because of the extreme speed or light transmission of Nikon lenses.

The Nikon 5A also features a 4-lens turret. A twist of the turret changes the magnification. And the image remains in exactly the same screen position for each lens.

Focusing with the 5A is completely effortless, and virtually automatic. Two instantly reversible motors drive the counterbalanced stage carriage—raising or lowering it, as required. The motion is smooth and steady. One motor provides the fast motion for coarse focusing, and the other operates the carriage for fine focusing. Cut-out micro-switches at the extreme travel limits of the carriage automatically shut off the motors.

A wide assortment of accessories is available: cross-moving and revolving micrometer stages of every conceivable design, including a stage with optical reading, also holding fixtures, protractor screens, charts and photo accessories.

Other
NIKON OPTICAL COMPARATORS

Model 2

Model 3

Model 6

for complete details, write to: Dept. TE-6
NIKON INCORPORATED 111 FIFTH AVENUE, NEW YORK 3, N. Y.

WHY BUY METAL YOU DON'T USE?

Switch to Allegheny Ludlum Cast-to-Shape Tool Steel

FORGING

Stepped-out forging for fabricating spinning cone: 2300 lbs.—$2691 material cost plus cost of machining.

CAST-TO-SHAPE

Cast-to-shape spinning cone 1059 lbs. $860.97 Includes cost of the pattern.

$1,831 Saved by changing to Cast-to-Shape

Why pay for metal that ends up as chips on your floor? Here are two fine reasons for switching to Allegheny Ludlum cast-to-shape tool steels.

CAST-TO-SHAPE MEANS YOU BUY FEWER POUNDS OF METAL.
Because the tool you buy is closer to its finished shape, you obviously spend less money on original metal. In the above example, the savings in metal cost alone amount to $1,894.

CAST-TO-SHAPE MEANS LESS FINISH MACHINING.
A casting like that above has only ¼ to ⅜ inches of machine stock on all surfaces, requiring very little machining compared to solid chunks. Cast-to-shape tooling is especially economical when working with intricate shapes.

Allegheny Ludlum, a tool steel producer who makes cast-to-shape materials, casts them with the same precise quality control for which their tool steels is known. A full line of cast-to-shape tool steel grades is available. You'll find ones with high resistance to abrasion, compressive strengths of approximately 400,000 psi, easy machinability, hardening with almost no distortion, toughness, high red hardness, and the capacity to take a high polish.

Find out now how you can cut costs on your complex tools. Write for FC-4, a 28-page technical discussion of A-L's Forging and Casting Division with applications, pattern information, design tips, analyses, and heat treating instructions. Or call your nearest A-L tool steel warehouse or distributor.

ALLEGHENY LUDLUM STEEL CORPORATION, OLIVER BUILDING, PITTSBURGH 22, PENNA.
Write to Dept. TE-6

7270

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country . . . Check the yellow pages

EVERY GRADE OF TOOL STEEL . . . EVERY HELP IN USING IT

Index of Advertisers

June 1960

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

*Exhibitor in 1960 ASTE Industrial Exposition ♦1959 Suppliers Directory Issue Advertiser

REGIONAL ADVERTISING OFFICES:

Austin G. Cragg, Director of Sales, 400 Madison Avenue, New York 17, N. Y., Telephone Plaza 9-4018
NEW YORK: Austin G. Cragg, Francis Baldwin, John Clarke, 400 Madison Avenue, New York 17, N. Y., Telephone: PLaza 9-4018
WEST HARTFORD: Donald N. McElwain, 2636 Albany Avenue, West Hartford, Conn., Telephone: ADams 3-5997
ATLANTA: Gus Krimsier; Cogill, Pirnie & Brown, 1722 Rhodes-Haverty Bldg., Telephone: JAckson 2-8113
CLEVELAND: George J. Zavis, 1367 E. Sixth Street, Lincoln Bldg., Room 200, Cleveland 15, Ohio, Telephone: TOwer 1-0330
CHICAGO: Stanley F. Girard, 612 N. Michigan Avenue, Chicago 11, Illinois, Telephone: MIchigan 2-4465
DETROIT: Alan Cobleigh, 10700 Puritan Avenue, Detroit 38, Michigan, Telephone: UNiversity 4-7300
LOS ANGELES: Robert E. Ahrensdorf, 3275 Wilshire Boulevard, Los Angeles 5, Calif., Telephone: DUnkirk 2-7337

LOOKING AHEAD

By T.W. Black
Senior Associate Editor

Steelmakers have developed a number of new materials that have greatly improved strength-to-weight ratios. Several of these are of particular interest to tool and manufacturing engineers.

Tissue-paper-thin strips of stainless steel alloy — wound layer upon layer — are helping to contain the tremendous force developed in rocket engines fueled by solid propellants. In experimental fabrication conducted by Ryan Aeronautical Co., multiple strips of ultrahigh tensile strength AM-355, a precipitation-hardening stainless steel, were wound, then spotwelded, into a strong cylindrical rocket chamber that withstands 305,000 psi hoop stress.

The usual high psi stress formerly reached by the rocket and missile industry was 240,000 psi, obtained with a single thickness of low-alloy steel, either forged, forged-and-spun, or rolled-and-welded. The new technique is probably the best method known for restraining high surge pressures.

Another stainless steel, USS "T-1," has been newly developed for the missile industry. Light, flat-rolled sections have about three times the yield strength of structural carbon steel rolled to the same thickness and weight. First use of the new steel has been for a supporting vehicle for the Sergeant missile. The entire vehicle weighs only 16,000 pounds, some 7000 pounds less than if it had been made with standard-strength steel.

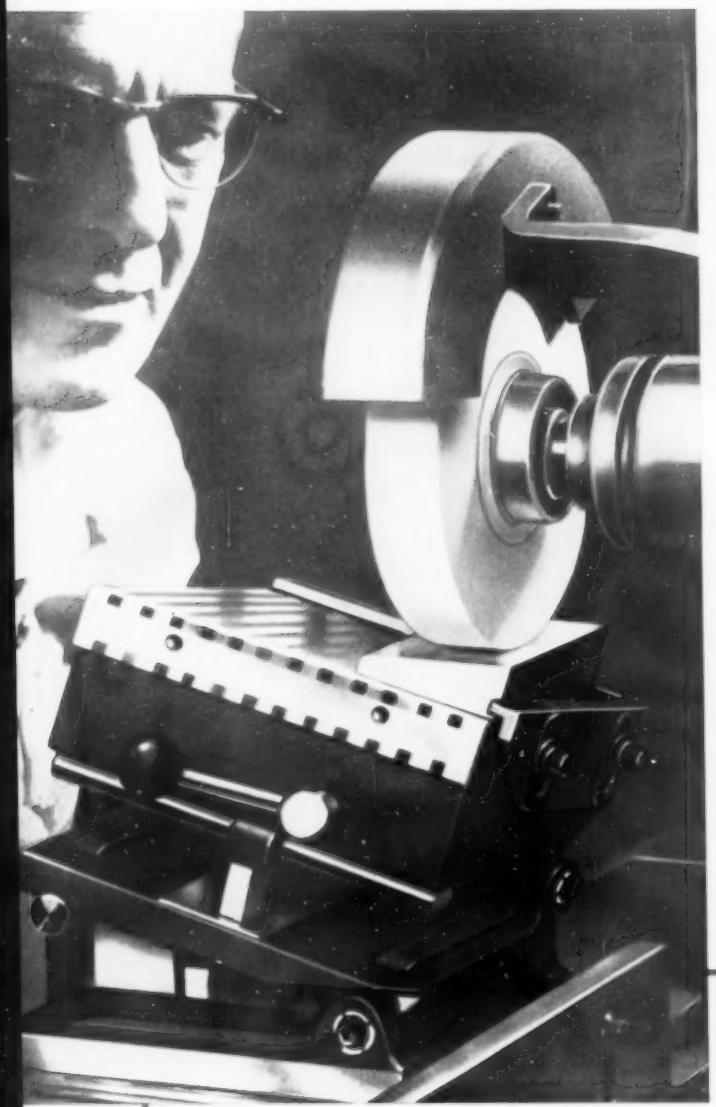
Use of computers has been extended to the design of cutting tools. National Broach & Machine Co. is utilizing digital computer equipment in the design of gear shaving cutters, gear honing tools, master gears and broaching tools.

A design program for a tool such as a shaving cutter always starts with a complete analysis of the mating conditions of the gears the tools will produce. This requires mathematical calculations that may take dozens of engineering man-hours. All of these calculations can be performed by a computer in minutes.

A more routine use of computers in manufacturing is the preparation of programs and tapes for numerically controlled machine tools. Many companies have put off the purchase of numerically controlled machines because they do not have personnel who are familiar with the use of computers.

Boeing Airplane Co.'s Wichita Div., which has the largest concentration of numerically controlled machines in the country, has established a new computer center where any company can obtain numerical control computing service. These services include machine programming of parts, tools, dies and templates, and the complete preparation of machining tapes.

NOW—SINE PLATES FROM EX-CELL-O!



EX-CELL-O ADDS ROBBINS MAGNA-SINE TO LINE OF PRECISION GAGE AND INSPECTION EQUIPMENT

Magna-Sine and non-magnetic sine plates, formerly manufactured by the Omer E. Robbins Company, are now part of the famous Ex-Cell-O line of precision inspection, gaging, and machining equipment.

With Ex-Cell-O Magna-Sine you set up any angle, single or compound, right or left hand, without V-blocks, angle plates, or complicated "build-ups". Just select the proper gage blocks, place them between the base and roll bar swivel block, flip the locking device . . . and you're ready to go! And Ex-Cell-O Magna-Sine holds work securely—without clamps—by the most powerful holding force ever built into a permanent chuck magnet.

Ex-Cell-O sine plates are available in a complete range of sizes and models, magnetic and non-magnetic, for every machining and inspection operation.

The Machine Tool Exposition—1960

•

See Ex-Cell-O In Booth 946

MMT-PE — MODERN MACHINE TOOLS — PRODUCTION EFFICIENCY

New Ex-Cell-O 90° Indicator Gage

For faster, easier, precision checking of squareness, use the new Ex-Cell-O 90° Indicator Gage—plus or minus accuracy to .0001" is instantly registered on its dial gage. Surfaces up to 17¾" long can be checked with each reading. Also, when used with Ex-Cell-O precision sine plates, this time-saving indicator gage will quickly measure the accuracy of angles other than 90°.

EX-CELL-O FOR PRECISION

Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING & BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • CONTOUR PROJECTORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

60-51

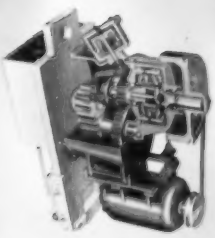
The Clearing Torc-Pac Press—

"MAINTENANCE-FREE OPERATION"

ITS TORC-PAC DRIVE IS SEALED-IN-OIL AND GUARANTEED FOR 18 MONTHS

Press clutch and brake maintenance is expensive and resulting downtime is a costly aggravation to production men. In the Clearing Torc-Pac O.B.I., maintenance of these critical components is eliminated completely. We're so sure of the perfect operation of the Torc-Pac press that we have sealed the drive to prevent unnecessary tampering. The drive is guaranteed for eighteen months provided that the seal is unbroken.

Torc-Pac is the press built with the new "building block" concept in mind. Therefore, a single spare drive unit can serve as a replacement for a shop full of Torc-Pacs. Find out about the only really new O.B.I. in 25 years—the Clearing Torc-Pac.



SINTERED BRONZE CLUTCH AND BRAKE LININGS ARE "OIL PLATED" AGAINST WEAR.

USI Clearing
Division of U.S. Industries, Inc.
6499 West 65th St. • Chicago 38, Ill.

Write for fact filled catalog

Look for the CLEARING NAME on these products

Mechanical Presses • Hydraulic Presses • Torc-Pac O.B.I. Presses • Axelson Lathes • Harrison Lathes • Special Equipment for Aircraft and Missiles Mfg. • Dies • Torc-Pac Drives • Research and Development